

Computer-Assisted Training Programme in Comprehensive Reading

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Introduction

This paper partially reports on the results of an experimental evaluation of training program for comprehensive reading, constituted by a set of learning strategies and supported by a software application denominated e-PELS[©] (Programa Virtual de Entrenamiento en Lectura Significativa - Electronic Training Program for Comprehensive Reading). The subjects that participated in this experimental evaluation were elementary students of 4th grade in a Chilean County School.

The paper begins with the identification of the research problem: Chilean children and adults low level of reading comprehension. It then presents a brief conceptual background on which the training programme is based. Thirdly, some of the training programme activities are presented. Next, the characteristics of the experimental work are described and the hypothesis stated: the students were trained with e-PELS (experimental group) would significantly improve their reading comprehension in contrast with the students that did not take part in the programme (control group).

It follows a discussion on compared results for the control and experimental groups: pre-test and post-test are analyzed and an appraisal on the set of learning strategies for the provision, development and transference of reading strategies.

Finally, a few remarks are made as a way of conclusions and the references are listed.

The Research Problem

Chilean and international studies and some two-yearly measurements such as IALS, PISA+, SIMCE and PSU (MINEDUC 2003, 2006b; OECD 2000) show important reading comprehension difficulties shown by Chilean students and adults. This problem has major effects for school performance and professional success.

The Education Ministry has defined a curriculum framework to focus the pedagogical work on learning rather than on teaching; re-orienting classroom work from instructional activities towards activities based on exploration, information searching, and knowledge building. This requires the learning process be oriented towards the development of basic and higher cognitive skills and abilities. The Ministry also indicates that to head to an affective teaching curriculum, appropriate didactic resources are required (MINEDUC, 2006a). However, the appropriation of such resources requires by learners to develop suitable learning strategies in order to acquire, codify, retrieve and support the processing of contents packed in learning activities that make use of such resources. Roman (2204) suggests that a mechanism to provide the learner-reader with adequate learning skills is the development of training programmes.

The virtual training programme in comprehensive reading (e-PELS[©]) implements a series of micro learning strategies whose practice is supported by a software application developed with interactive software components.

Background

The major theoretical influences to this work are deep learning, learning skills, visual learning and reading comprehension.

Deep learning is immersed within the constructivist view and is the opposite of memoristic or repetitive learning (Ausubel 1963). Deep learning arises when substantive and non arbitrary relationships are built between what is already known (previous content) and what is to be learnt (new content) (Coll and Sole, 1989, Coll, 1991, Moreira, 1993). Thus, learning is an active process where new understandings are built by designing and creating meaningful experiences for learners. This should facilitate the organization of learner's cognitive structure (Entwistle, 1981, Gibbs, 1999). Three

requisites are required to accomplish deep learning. Firstly, logical significance of content, contents should be intentionally organised so that the learners can build relations with ideas in their cognitive structure and construct new knowledge. Secondly, psychological significance of content, related to the internal representation made by the learners of logical significant content. Thirdly, learners' favourable attitude given by the disposition to substantively, profoundly and no literally relate their cognitive structure with the new material (Ausubel et al 1968, Gibbs et al 1998). The presence of deep learning in educational environments depends upon de mediation between didactic (methods and strategies) and learning outcomes. This requires a rigorous and systematic teaching and learning planning, including content and aims characteristics, learner starting level, methods, didactic sequences, and learning strategies to facilitate deep meaning of contents and activities (Coll and Solé 1989).

Learning strategies are defined as the specific actions which are consciously and intentionally chosen to learn given contents. Learning strategies can be grouped in various levels according to cognitive processes. One scheme is proposed by Roman and Gallego (1994) and includes strategies for information acquisition (text underlined; text colouring, loud reading); for information coding (sequences, self questioning, paraphrasing, diagrams, conceptual maps, graphic organisers); for information retrieval (mental imaging, abstractions, problem solving); and for information processing support (schedules, study groups, inductions). An adequate selection, combination and iterative used of learning strategies engender a cognitive automatism, which improves learning levels (Roman 2004).

A subset of the listed learning strategies requires visual schemes for their materialization, such as text underlined or conceptual maps. Among the advantages of learning strategies that require visual representation are: facilitate thinking processes, reinforce comprehension, ease new knowledge integration, and help the identification of erroneous concepts (Gadner 2003). Visual diagrams facilitate reading ability and develop scheming and synthesis through registering, analysing and synthesising findings.

Generally, the use of linguistic elements (words, phrases) and non linguistic (symbols, shapes, connectors) are known as graphic organisers (Marzano et al 2001). Basic and transversal learning skills, such as term grouping, cause and effect relations, analogy composition, similarities and differences identification, sequence presentation, synthesis making, are translated and

easily modelled into a graphic organiser. The iterative and systematic use of the graphic organisers will develop and enforce the learning skills. Graphic organisers assist the learning and evaluation process, since they are key methodological resources to link previous and new knowledge, that is, graphic organisers facilitate deep learning.

To facilitate a comprehensive reading of texts, three moments are relevant: before, during and after reading (Condemarin and Medina 2000). Before reading, it is required tools and techniques to activate and develop previous knowledge, which is central to comprehension and significance. During reading, it interests to observe how learners process the meaning of texts, how inferences or predictions or questions are made, how mistakes are corrected. All these allow the construction of new and deep knowledge. After the reading, it interests to detect how the learner synthesis, comments or express what has been read. Techniques such as remembering or paraphrasing, graphic organisers, abstracts, critical reading or literary circles mirror what the learner thinks about the source text. Therefore the effort to evaluate is not only on the product but on the learning process, which requires a series of tools within a logic of action-observation-reflection-new action (experiential learning) allowing both learners to build deep learning and teachers to collect evidence of such learning process.

The training programme

The virtual training programme in comprehensive reading (e-PELS[®]) was designed and developed following Roman (2004) and Roman and Gallegos (1994), who proposed a training programme in comprehensive reading based on a set of cognitive and meta-cognitive skills. The basic cognitive processes identified are (1) information acquisition strategies, (2) information coding strategies, (3) information retrieval strategies, and (4) information processing support strategies. In his original proposal, Roman suggested the following strategies: underlining, paraphrasing, self questioning, text structure and conceptual maps. Our training program e-PELS expanded conceptual mapping to the use of interactive graphic organisers and added a strategy for summarising.

For the acquisition strategies, e-PELS includes underlining or colouring, to stand out relevant words or phrases, and paraphrasing, to allow students their own wording of texts. For the coding strategies, e-PELS incorporates the text structure strategy (problem-solving, cause-effect, descriptive, comparison and time sequence), self questioning to relate and think about the text, and interactive

graphic organisers for the organisation of ideas or arguments within the source text.

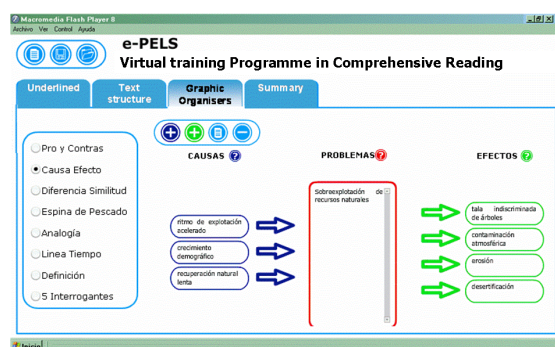


Figure 1: e-PELS in use

For the retrieval strategy, e-PELS incorporates the summary for synthesising the text. e-PELS also includes other functionalities which are typical to this sort of Web software: new, open, save. It is notable that e-PELS can easily be integrated to existing Web software.

The experimental design

The main hypothesis was that the students participating in the virtual training programme in comprehensive reading and use the e-PELS software (experimental group) will significantly increase both their reading comprehension and the associated learning strategies in relation to the students who did not participate in the training programme. The dependent variables were two: the domain of the comprehensive reading strategy and the reading comprehension. The first variable had the following sub variables: underlining, paraphrasing, text structure and self questioning, graphical organisation and summary. Reading comprehension was defined as established in the reading test Progressive Linguistic Complexity (PLC) (Alliende et al 2004). CLP defines eight levels of readings and, for this experiment, it was used level 3 form A as pre-test and form B as post-test. The independent variable was the virtual training programme in comprehensive reading, which allows students to grasp reading strategies in a brief time; it takes two values (1) with training programme and (2) without training programme.

The sample was selected by the psycho-pedagogical unit of the school and corresponded to 20 elementary students of fourth grade who had reading comprehension problems, which was acknowledged with the Chilean standardised Spache test (Sepulveda and Jofre, 1984). Experimental and control groups were randomly formed with ten students each.

The experiment was conducted in three stages: pre-test; training sessions with e-PELS; and post-test. As pre-test it was used form A of the PLC test, which was applied to both control and experimental groups. The second stage was the implementation the training programme in 11 sessions of two-hours each at the school's computer laboratory.

N	Activity
1	Underlining
2	Underlining
3	Paraphrasing
4	Text structure and self questioning
5	Interactive graphic organisers (IGO's)
6	Interactive graphic organisers
7	Integration of seen strategies
8	Summary and integration of strategies
9	Integration of seen strategies and IGO's
10	Summary and all strategies.
11	All strategies

Table 1: Learning strategies per session

Sessions were organised around experiential learning (Kolb, 1984), that is, the experience accumulated during one session is transferred to the next session. Once the training programme was over, experimental and control groups were tested with form B of CLP.

Results

Table 2 presents the statistical analysis for the pre-test for the experimental group, which shows that the experimental group had deficiencies in comparison with the CLP reference group (see Z and T punctuation and Percentile).

	PUNTUATIONS			
	BRUT	Z	T	Percentile
St 1	12	-0.89	41.1	20
St 2	9	-1.65	33.5	10
St 3	12	-0.89	41.1	20
St 4	14	-0.37	46.6	30
St 5	14	-0.37	46.6	30
St 6	12	-0.89	41.1	20
St 7	7	-2.17	28.3	10
St 8	15	-0.12	48.8	40
St 9	17	0.39	53.9	60
St 10	14	-0.37	46.6	30

Table 2: Pre-test experimental group

Table 3 presents the statistical analysis for the pre-test for the control group, which also shows that the group had similar deficiencies. In fact, there is no difference between experimental and control groups (t-student=0.730, p-value=0.474, df=18 and $\alpha=.05$).

	PUNTUATIONS			
	BRUT	Z	T	Percentile
St 1	14	-0.37	46.6	30
St 2	15	-0.12	48.8	40
St 3	16	0.14	51.4	50
St 4	13	-0.63	43.7	30
St 5	7	-2.17	28.3	10
St 6	14	-0.37	46.6	30
St 7	14	-0.37	46.6	30
St 8	12	-0.89	41.1	20
St 9	16	0.14	51.4	50
St 10	14	-0.37	46.6	30

Table 3: Pre-test control group

Table 2 and 3 show that the experimental and control groups are homogeneous as far as their reading comprehension is concerned, which is consistent with the experimental design.

Table 4 shows the results of the post-test for the experimental group, which was carried out after the virtual training programme was completed. (Brt = BRUT; Δ = difference; Prct = Percentile).

	PUNCTUATION					
	BRUT		Z Value		Percentile	
	Brt	Δ	Z	Δ	Prct	Δ
St 1	12	0	-0,91	-0,02	20	0
St 2	12	3	-0,91	0,74	20	10
St 3	15	3	-0,06	0,83	40	20
St 4	19	5	1,07	1,44	90	60
St 5	9	-5	-1,76	-1,39	10	-20
St 6	17	5	0,51	1,40	70	50
St 7	12	5	-0,91	1,26	20	10
St 8	8	-7	-2,04	-1,92	10	-30
St 9	13	-4	-0,63	-1,02	30	-30
St 10	-	-	-	-	-	-

Table 4: Post-test experimental group

It can be observed in table 4 that nine of the students who gave the form B of PLC, and actively participated in the e-PELS programme, significantly improve their level of reading comprehension regarding their pre-test (t-student = 4.34, p-value = 0.007, df = 5 and $\alpha = .05$). Z punctuations show that five students achieve a better level of reading comprehension, although three students remain below the average.

Table 5 shows the results of the post-test for the control group, which was also carried out after the virtual training programme was completed.

	PUNCTUATION					
	BRUT		Z Value		Percentile	
	Brt	Δ	Z	Δ	Prct	Δ
St 1	-	-	-	-	-	-
St 2	15	0	-0.06	0,06	40	0
St 3	14	-2	-0.34	-0,48	40	-10
St 4	13	0	-0.63	0,00	30	0
St 5	11	4	-1.19	0,98	20	10
St 6	15	1	-0.06	0,31	40	10
St 7	14	0	-0.34	0,03	40	10
St 8	13	1	-0.63	0,26	30	10
St 9	15	-1	-0.06	-0,20	40	-10
St 10	12	-2	-0.91	-0,54	20	-10

Table 5: Post-test control group

The control group does not show significant changes in their reading comprehension level after the four months of work of the experimental group (t-student = 0.107, p-value = 0.915, df = 16 and $\alpha = .05$). Furthermore, those students who were above the average (Z positive) show a marginal loss.

It is important to remember that both groups control and experimental were diagnosed with difficulties in reading comprehension.

Given the observed results for control and experimental groups, it is encouraging to see that the majority of the students who participated in the virtual training programme show a better performance in the reading comprehension. Assuming that other variables were not altered, that the school kept its normal activities as much for the control group as for the experimental group, it is possible to point to the virtual training programme in comprehensive reading (e-PELS[®]) as the cause for the observed improvement. Thus the initial hypothesis is confirmed.

On other hand, it is notorious that the reading comprehension performance by the students in the control group did not show significant variation. What one would expect is that after four months that elapsed between pretest and posttest and under normal school conditions the control group showed improvement on their reading comprehension. In contrast, a positive variation is only seen in the experimental group that participated with e-PELS.

How is it explained the improvement in the level of reading comprehension shown by the experimental group? The evidence shows that the results are due to the participation of students in the e-PELS programme, which trained students in a set of learning strategies for the endowment, development and transference of reading strategies.

It follows a review of student's performance in each of the strategies: underlining, paraphrasing, text

structure and self questioning, graphical organisation and summary.

Underlining: After seven training sessions, a positive evolution was observed in the use of the strategy of underlining. Most students identified keys words or phrases, without underlining extensively.

Paraphrasing: Student's ability to articulate more significant own phrases increased as the sessions went by. The paraphrasing, initially seen as an end, it is soon transformed into a skill to produce small pieces of text increasingly personalized and significant.

Text structure and self questioning: This evolved from a level of recognition up to a level of integration and coherence. It was observed that the students who could only recognise the underlying structure were able at the end of the programme to suitably relate and integrate the elements presented in the source text.

Graphical organisation: The interactive graphic organizers were perceived as tools for first level processing. The search of top levels processing that involve major capacity of synthesis and abstraction is a pending chapter for this training programme.

Summary: The students understood summary as a composition of the source text and articulated expressions very close to the literal tenor of the original text. Not eliminating redundant or secondary information allowed students to coincide with the author and to minimize the risk of having omitted something that could be important.

Conclusions

The experimental design for the virtual training programme in comprehensive reading rests on 6 pillars that not only sustain their logic but also the expectations of the observed results. The pillars are: sample and context; domain of reading skills; competence-evidence duality; experiential learning; iterative and systematic use; and information processing.

Sample and context: the designed sample considered the natural environment of the participant students, including their low reading comprehension profile.

Domain of reading skills: the aim of the experimentation was the endowment and development of learning strategies included in the training programme. The satisfaction of the research team is guaranteed when students

appropriated and evoked their new reading strategies to experimental and classroom situations.

Competence-evidence duality: e-PELS is associated with the domain of strategies that accomplish with a double purpose: (a) to facilitate the continuous learning that the learner faces in a reading situation, and (b) to allow the development of cognitive, procedural and metacognitive skills that could be evoked by students whenever they face a reading challenge.

Experiential learning: in spite of the small number of sessions conducted in this experiment, students were able to capitalise their experience and modify their cognitive and strategic schemes and to face the new reading challenges with more maturity and incremental expertise.

Iterative and systematic use: all the above was possible because the programme was designed and applied in compliance with the required iteration of activities. The elements of the programme were duly administered and rules enforced for an opportune and orderly management.

Information processing: following the present pedagogic approach, e-PELS is a mechanism for processing contents and facilitates the acquisition of strategies and the materialization of reading comprehension based on the significant learning approach.

The e-PELS programme showed to be useful for student to link previous knowledge and experiences with new knowledge. Finally and most importantly, e-PELS allowed the practice and facilitate a deep learning process.

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