

A Web-based Training Programme in Comprehensive Reading

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Abstract

In this paper we present the results of an experimental evaluation of a training programme for comprehensive reading. The training programme was constituted by a set of learning strategies supported by web-based application. The subjects were 4th grade elementary students. The hypothesis stated that students trained on the learning strategies and supported by the web based application (experimental group) would significantly improve their reading comprehension in contrast with those students that did not take part in the programme (control group). The results indicate that the experimental group improved its reading comprehension level compared with the control group.

Introduction

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

The Chilean Education Ministry (MINEDUC, 2006a) defined a curriculum framework to focus pedagogical work on learning rather than on teaching. The purpose of this new framework was to adjust classroom work from instructional activities towards exploration, information searching, and knowledge building activities. Such transformation requires that learning process aims towards the development of basic and higher cognitive skills and abilities.

The Ministry also indicated that appropriate didactic resources are required to head to an affective teaching curriculum. However, the appropriation of such resources requires that learners develop suitable learning strategies in order to acquire, codify, retrieve and support the processing of content packed in learning activities that make use of such resources. Roman (2004) suggests that a mechanism to provide the learner-reader with adequate learning skills is the development of training programmes in learning strategies.

In this paper, we present a web-based training programme in comprehensive reading (e-PELS) developed with interactive software components that implements a series of learning strategies. This training programme and its effects on reading comprehension were evaluated through an experimental research design. The subjects were 4th grade elementary students. The results indicated that the experimental group improved its reading comprehension level compared with the control group.

Background

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

Deep learning, within the constructivist view, is the opposite of memoristic or repetitive learning (Ausubel 1963). Deep learning arises when students build substantive and non arbitrary relationships between what they already know (previous content) and what they will learn (new content) (Coll and Sole, 1989, Coll, 1991, Moreira, 1993). Thus, learning is an active process where students build new understanding by designing and creating meaningful experiences. 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 not 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 the 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 specific actions chosen consciously and intentionally to learn given contents. According to cognitive processes, Roman and Gallego (1994) group learning strategies in various levels. These are 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 (schedules, study groups, inductions). An adequate selection, combination and iterative use of learning strategies prompt 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, graphic organisers are linguistic elements (words, phrases) and non linguistic (symbols, shapes, connectors) (Marzano et al 2001). Many basic and transversal learning skills can easily translate into a graphic organisers; for example, term grouping, cause and effect relations, analogy composition, similarities and differences identification, sequence presentation, synthesis making, and others. The iterative and systematic use of the graphic organisers develops and enforces 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.

Three moments are relevant to facilitate a comprehensive text reading: 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 they make inferences or predictions or questions, how they correct mistakes. All these allow the construction of new and deep knowledge. After the reading, it interests to detect how the learner synthesises, 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 programme 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.

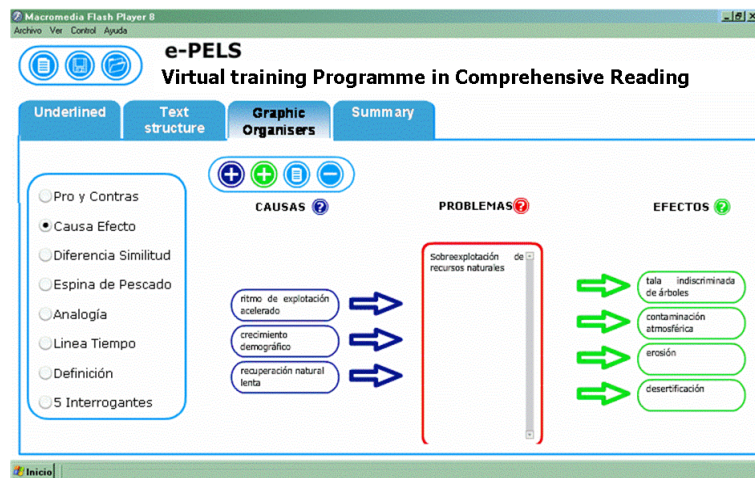


Figure 1: e-PELS in use

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

The experimental design

The main hypothesis was that 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 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. The Progressive Linguistic Complexity (CLP) reading test (Alliende et al 2004) provided the meaning of reading comprehension. CLP defines eight levels of readings and, this experiment 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 school psycho-pedagogical unit selected the sample which corresponded to 20 elementary students who had reading comprehension problems, obtained through the fourth grade Chilean standardised Spache test (Sepulveda and Jofre, 1984). Experimental and control groups were randomly formed with ten students each.

The experiment had three stages: pre-test; training sessions with e-PELS; and post-test. The pre-test was form A of the CLP test, and administered to both control and experimental groups. The second stage was the implementation of the training programme in 11 sessions of two-hours each at the school's laboratory with 10 computers.

c	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

Experiential learning provided the basis for session organisation (Kolb, 1984); that is, the experience accumulated during one session transfers to the next one. Form B of CLP was the post test, at the end of the training programme.

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			
	SCORE	Z	T	Percentile
Student 1	12	-0.89	41.1	20
Student 2	9	-1.65	33.5	10
Student 3	12	-0.89	41.1	20
Student 4	14	-0.37	46.6	30
Student 5	14	-0.37	46.6	30
Student 6	12	-0.89	41.1	20
Student 7	7	-2.17	28.3	10
Student 8	15	-0.12	48.8	40
Student 9	17	0.39	53.9	60
Student 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			
	SCORE	Z	T	Percentile
Student 1	14	-0.37	46.6	30
Student 2	15	-0.12	48.8	40
Student 3	16	0.14	51.4	50
Student 4	13	-0.63	43.7	30
Student 5	7	-2.17	28.3	10
Student 6	14	-0.37	46.6	30
Student 7	14	-0.37	46.6	30
Student 8	12	-0.89	41.1	20
Student 9	16	0.14	51.4	50
Student 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 carried out at the end of the virtual training programme, for the experimental group, (S = Score; Δ = difference; P = Percentile).

	PUNCTUATION					
	SCORE		Z Value		Percentile	
	S	Δ	Z	Δ	P	Δ
Student 1	12	0	-0,91	-0,02	20	0
Student 2	12	3	-0,91	0,74	20	10
Student 3	15	3	-0,06	0,83	40	20
Student 4	19	5	1,07	1,44	90	60
Student 5	9	-5	-1,76	-1,39	10	-20
Student 6	17	5	0,51	1,40	70	50
Student 7	12	5	-0,91	1,26	20	10
Student 8	8	-7	-2,04	-1,92	10	-30
Student 9	13	-4	-0,63	-1,02	30	-30
Student 10	14	-	-0,37	-	30	-

Table 4: Post-test experimental group

It can be observed in table 4 that five of the students who gave the form B of CLP, 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 α = .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 carried at the end of the virtual training programme for the control group.

	PUNCTUATION					
	SCORE		Z Value		Percentile	
	S	Δ	Z	Δ	P	Δ
Student 1	14	-	-0.37	-	30	-
Student 2	15	0	-0.06	0,06	40	0
Student 3	14	-2	-0.34	-0,48	40	-10
Student 4	13	0	-0.63	0,00	30	0
Student 5	11	4	-1.19	0,98	20	10
Student 6	15	1	-0.06	0,31	40	10
Student 7	14	0	-0.34	0,03	40	10
Student 8	13	1	-0.63	0,26	30	10
Student 9	15	-1	-0.06	-0,20	40	-10
Student 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 α = .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 no changes in other variables; that is, 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, which confirms the initial hypothesis.

On other hand, control group students did not show significant variation in their reading comprehension performance. What one would expect is that after four months between pretest and posttest and under normal school conditions the control group would show improvement on their reading comprehension.

Discussion

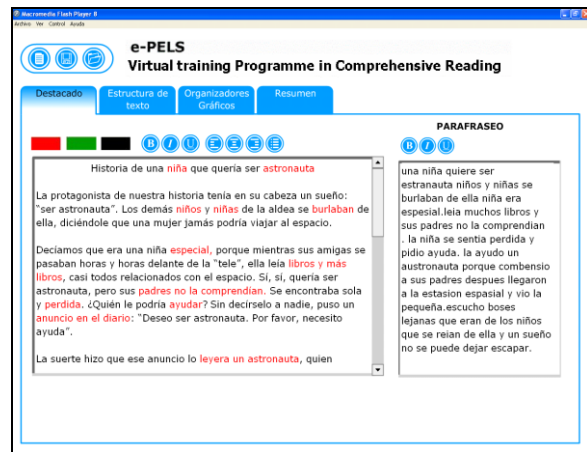
How is it explained the improvement in the level of reading comprehension shown by the experimental group? The evidence shows that the results are due to the participation of students in the e-PELS programme, which trained students in a set of learning strategies for the endowment, development and transference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

As said, 10 students participated in the experimental group, but one had to withdraw due to health reason, hence the discussion includes the average results of the other nine students. Although averages hide individual behaviour, they do represent the group performance, particularly because the standard deviations are generally low.

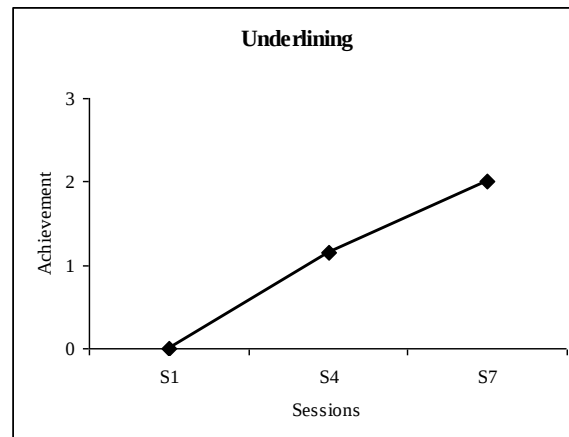
Underlining assessment was at three of the eleven sessions, i.e. sessions 1, 4 and 7. To assess students' achievement of the underlining strategy, a three-range scale was designed, as described in the following table:

Indicator	Name	Description
1	Recognition	The student identifies and marks words in the text, for example, title, problems, situations, among others.
2	Selection	The student highlights key words or ideas which may help to constitute the summary of what is being read.
3	Distinction	The student distinguishes between main ideas from the secondary ones; for example, use of red for main ideas and green for secondary ones.

The following graphs show a typical use of the underlining strategy and the average marks for the group of students.



Use of underlining



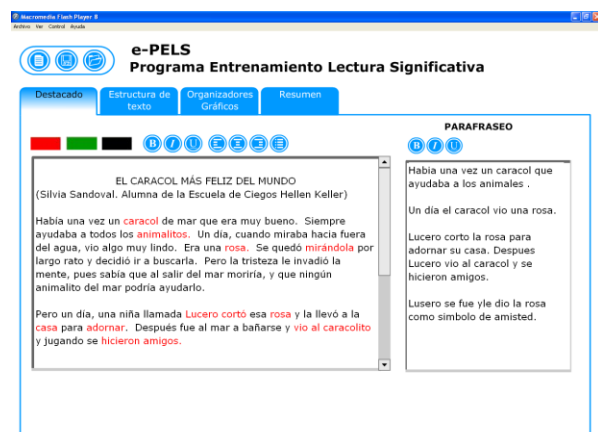
Average marks

At the outset, students did not know how to use the highlighting strategy; they were not able to differentiate key words or ideas for a later understanding of the message included in the text. By the seventh training, most students identified keys words or phrases, without underlining extensively.

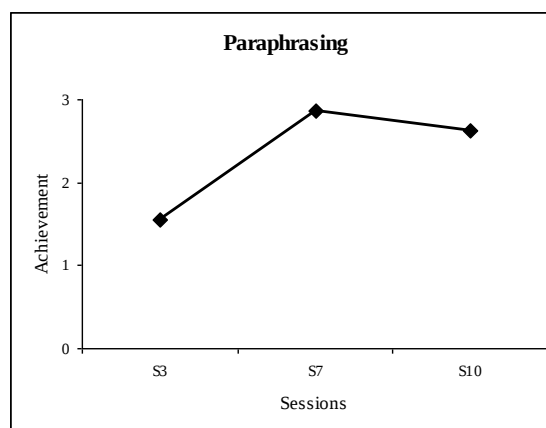
Paraphrasing assessment was at sessions 3, 7 and 10 and rated in a five-range scale, as follows:

Indicator	Name	Description
1	Incoherence	The student does not give details, adds non relevant elements, is not coherent, is incomplete and is incomprehensible.
2	Partial recognition	The student gives some relevant and secondary ideas, includes some non relevant elements, keeps some incoherence, but is fairly comprehensible.
3	Comprehension	The student describes main ideas, includes relevant secondary ones, is coherent and comprehensible.
4	Synthesis	The student includes headings, all relevant and secondary ideas, is coherent and comprehensible.
5	Abstraction	The student makes generalizations beyond the text, includes headings, all relevant and secondary ideas, and is coherent and comprehensible.

The following graphs show a typical use of the paraphrasing strategy and the average marks for the group of students.



Paraphrasing from underlining



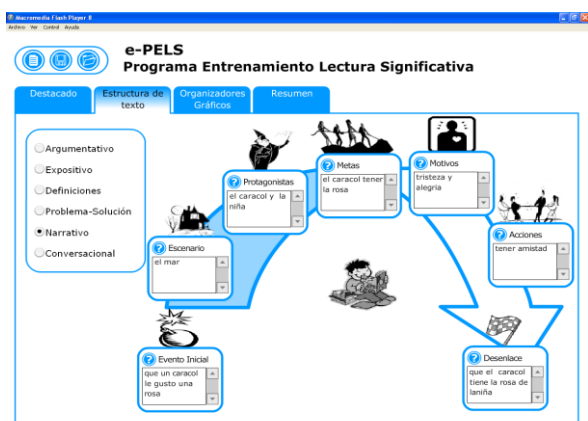
Average marks

The synthesis as a skill thinking skill (expertise of higher levels 4 and 5) was not present in these students; however, they replaced it by constructing phrases that correctly articulate the elements of the source text. Student's ability to articulate more significant phrases increased as the sessions went by. The paraphrasing, initially seen as an end, it was soon transformed into a skill to produce small pieces of text increasingly personalized and significant.

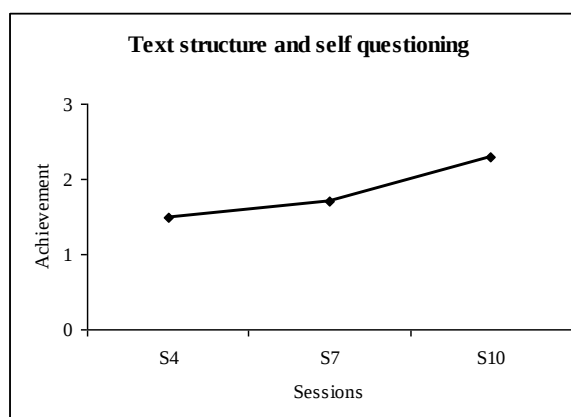
Text structure and self-questioning assessment was at sessions 4, 5 and 7 and the following scales used for marking.

Indicator	Name	Description
1	Recognition	The student identifies the structure or skeleton that characterizes the given text.
2	Integration	The student relates text elements with the underlying structure and fills in the form, demonstrating the apprehension of the content.
3	Accuracy	The student responds in clear and pertinent manner. In the best of cases, he/she establishes a sound relationship between the text and his/hers experience.

The following graphs show a typical use of the text structure and self-questioning strategy and the average marks for the group of students.



Use of text structure and self-questioning



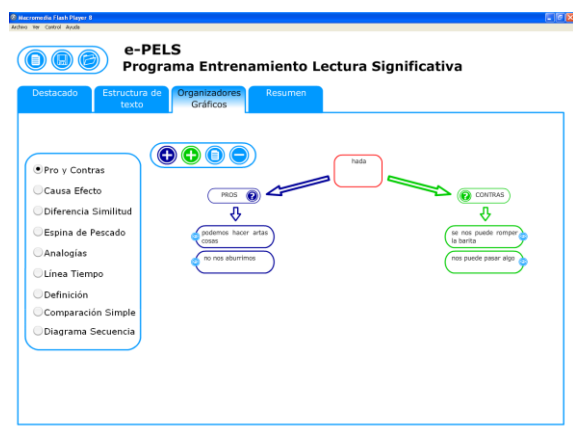
Average marks

The evidence shows that students understood increasingly the explicit text elements; to say the least: students show a superficial comprehension of the reading challenges present in their training. At this stage of the training, students were able to explore, process, repeat and maintain the reading's original sense. Text structure and self-questioning evolved from a level of recognition up to a level of integration and coherence. 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.

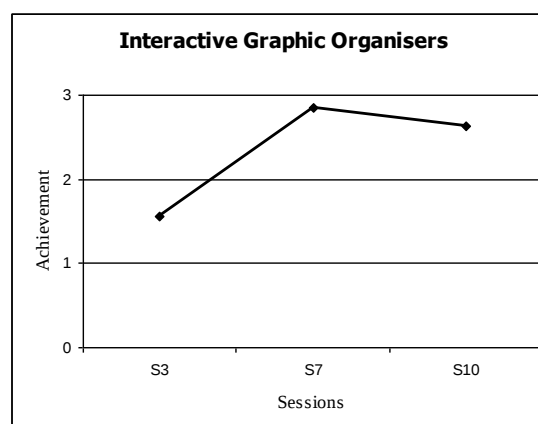
Assessment of **Graphical Organisation** was at sessions 3, 7 and 10 and marking carried out according to the following scale.

Indicator	Name	Description
1	Pertinence	The student selects the most suitable IGO to the explicit content in the source text.
2	Integration	The student incorporates text key and explicit concepts and considers IGO's pre-established structure and relationships.
3	Coherence	The student demonstrates coherence in IGO's use to clarify and to expose ideas beyond the source text.
4	Impact	The student, when using OGI's, operates a network of concepts and relationships to relate ideas in the source text to its own experience.

The following graphs show a typical use of the graphical organisation strategy and the average marks for the group of students.



Use interactive graphic organiser



Average marks

Students showed that it was easy to use the interactive graphic organisers. Students used the interactive graphic organizers as first level processing tools. The search of top levels processing that involve major capacity of synthesis and abstraction is a pending chapter for this training programme.

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. Students' new reading strategies appropriation to experimental and classroom situations provided much satisfaction to the research team.

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 became possible because the designed programme complied with the required iteration of activities. The elements of the programme, its administration and rules enforced permitted 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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