Computers in Human Behavior xxx (2014) xxx–xxx

Contents lists available at ScienceDirect

Computers in Human Behavior

journal homepage: www.elsevier.com/locate/comphumbeh

The silent reading supported by adaptive learning technology: Influence in the children outcomes

Di Giacomo Dina [a,*], Cofini Vincenza [a], Di Mascio Tania [b], Cecilia Maria Rosita [a], Fiorenzi Daniela [a], Gennari Rosella [c], Vittorini Pierpaolo [a]

[a] Department of Life, Health and Environment Sciences, University of L'Aquila, Italy
[b] Department of Information Engineering, Computer Science and Mathematics, University of L'Aquila, Italy
[c] Computer Science Faculty, University of Bozen-Bolzano, Italy

ARTICLE INFO

Article history:
Available online xxxx

Keywords:
Interactive learning environment
Silent reading
Children
Comprehension
Primary education

ABSTRACT

In primary school, most children develop a deep comprehension skill in reading but not all children improve their learning competence in the same time and manner. Several children showed to prefer the silent reading but the traditional psychological/pedagogical approaches did not allow an improvement of their potential growth.

The purpose of the study is to examine the support of technology in the developmental process of the reading ability in childhood. We investigated the efficacy of the silent reading by technological interactive system based on 2 variables: (a) absence of constant adult supervision/intervention, and (b) child-technology interaction to promote the improvement of comprehension ability in reading.

A sample of n. 144 children in primary school with high and low reading abilities was subjected to a stimulation plan (duration 6 months) based on silent reading, smart games related to the stories reading and feedback though technology support (TERENCE program). The test–retest evaluation evidenced an increasing performance in the lower reading children. The results suggested the efficacy and the positive influence of technologies in the learning process: in the silent reading, the child may be better stimulated to learn and to comprehend the information using technology interactive. The adaptive learning technology might be considered a strong ally in educational environment to promote a greater cognitive enhancement in childhood.

1. Introduction

Telling, reading and understanding stories are activities by which we grow in our childhood. As the educators know, most children develop their deep comprehension skills in reading during the primary school. However, many children develop those skills late; the reason can be different. Moreover, not all children are able to use the reading mode (silent or aloud) effectively in the comprehension process.

The reading ability in developmental age is an interesting scientific topic; several researches were conducted to describe and explain the mechanisms that consent the increase of the cognitive processes (i.e.: comprehension, logic, memory, attention), the deficits' features and related interventions.

An interesting debate was on effect of the reading mode (e.g., aloud and silent) on comprehension ability in childhood. Studies showed the different impact of the reading aloud and reading silently on the comprehension ability but the results are equivocal. Some theories suggest that the individuals understand better the information after reading silently. Juel and Holmes (1981) describe the oral reading based on 'bottom up' process, according to the readers may stop processing after achieving phonological recordings. The researchers highlight the difficulty to verify whether the elaboration processes of reading depend on a stop of the lexical access or of the comprehension process. Furthermore, the younger readers may not have automatic decoding skills yet, so they focus their cognitive resources on phonological recording rather than on comprehension.

Kragler (1995) evidenced the best proficiency of aloud readers, which are facilitated in comprehension process because they are concentrated to listen to themselves while they read.

* Corresponding author at: Department of Life, Health and Environmental Sciences, University of L'Aquila, p.le Tommasi n.1, 67010 L'Aquila, Italy. Tel.: +39 0862434694.
E-mail address: dina.digiacomo@cc.univaq.it (D. Giacomo Dina).

http://dx.doi.org/10.1016/j.chb.2014.09.053
0747-5632/

Finally, McCallun's studies (2004) showed no significant differences between reading comprehension scores after aloud or silently reading.

The differences among the theories depend on the cognitive processes considered and the method of assessment. In reading aloud it is possible to measure different variables observing subject's performance (i.e.: correct words in a minute, speed, accuracy); in silent reading, the measurement is not assured because feedback and performance of the readers cannot be controlled in every steps.

The silent reading is a way of reading that makes critical the assessment of comprehension process considering the traditional approach, which sees the child engaged in the activity of reading alone and the psychological evaluation performed through tests applied by an examiner (Hale et al., 2007); the weakness is the difficult control of the child's performance during the silent reading. We want to examine the impact and potential efficacy of the silent reading supporting by technological interactive system, without the direct intervention of the adult or examiner. This research supports the efficiency of silent reading in the context of an individual assessment of reading comprehension. The functional association between reading and technology has been exposed broadly in Cheung and Slavin (2012) review's: the Authors argued the positive impact of the computer technology on reading outcome and the engagement of strategies for text comprehension using the computer to teach reading comprehension. Four variables were identified to enhance the children/student learning: quality of instruction (clear, well-organized, interesting), appropriate levels of instruction (the educator might consider the prior knowledge, skills and learning rates of the children to approach at the technological lessons), incentive (motivating the children) and time for practice and feedback. Cheung and Slavin (2012) highlighted the positive effect of the application of educational technology in comparison to traditional methods, in particular they established greater benefits for low learning ability.

In this research we want to verify the efficacy of the specific technological program on silent reading outcome applying it in a stimulation plan on children population in primary school. Aim of the stimulation plan proposal is the implementation of comprehension ability in silent reading in the childhood. In particular, the educational plan has been focused on the efficiency on silent reading in primary school age. In this experiment, we applied a technology named Adaptive Learning System (ALS): is a computer-based and/or online educational system that modifies the presentation of material in response to subject performance: the adaptive learning supports adaptive interaction, feedback and delivery of information and content. Using the technological interactive system (TERENCE program: Terence is an European FP7 ICT multidisciplinary project that develops an Adaptive earning System (ALS) for supporting poor comprehenders and their educators. The project is placed in the area of Technology Enhanced Learning (TEL). Coordinator: Prof. Pierpaolo Vittorini, University of L'Aquila) in a definite time (stimulation plan) we wanted to verify if the silent reading activity associated to specifically designed exercises could be an efficient program to facilitate the comprehension ability in children. The technological interactive system consisted of PC and ad hoc software with original stories and related exercises (i.e.: vocabulary, inference making, sentences). The program has been composed of two steps: reading stories and resolution of specific exercises. The stories have been written with increasing difficulty levels such as the exercises to resolve. The exercises have reflected the arguments, difficulty levels and language structures of each story. The improvement of reading ability has been represented by the progressive improvement in reading the stories; the increase of the comprehension ability in the silent reading has been represented by the children's enhancing performance in the resolution of exercises.

The secondary aim of the study will be verify the efficacy of Terence program in silent reading to promote the developmental process of the children not only by educator supervision (for example in classroom or in educational environment) but also in interaction with the technology in different context (in class, in home, in using at school and/or in play activity).

2. Materials and methods

2.1. Participants

The sample was composed of n. 144 children (n.79 male, n. 65 female) with mean age 8.8 (±1.1), all native Italian speakers. The participants have been divided in 2 groups: (a) the A group was composed of n. 68 children with low reading ability measured by scholastic performance, and (b) the B group was composed of n. 76 children with high reading performance; the reading ability evaluations had obtained by independent teachers, blinded by the objectives of the research. All participants attended the primary school in middle Italy. The recruitment of participants was achieved though the collaboration of the schools. We requested and obtained the written informed consensus by parents.

2.2. Experimental environment

The A group has been stimulated by Terence program in dedicated classroom of their school. Each participant used a PC with internet connection; every child had a login and a password that consented the connection to a server and the detection of every performance. The stimulation lasted 6 months (2 h at week in 2 time). Trained tutors supervised the children during the stimulation time.

2.3. Terence program: stimulation plan

The Terence program aims to carry out a software to improve the reading comprehension of its main learners. The program develops an Adaptive Learning System (ALS) (Alrifai, Gennari, Tifrea, & Vittorini, 2012; De la Prieta, Di Mascio, Gennari, Marenzi, & Vittorini, 2012; Di Mascio, Gennari, Melonio, & Vittorini, 2013): is a computer-based and/or online educational system that modifies the presentation of material in response to subject performance. Actually, on the www.terenceproject.eu is reported a demo-version of the program adopted in this protocol (free access).

The Stimulation Plan of comprehension ability in silent reading consist of 3 activities: (a) Reading Activity, (b) Smart Games Activity and (c) Relaxing Games Activity.

In the Reading Activity has been presented a story that the child must read in a fixed time. The story has been presented in textual and graphical forms: the textual form is composed of scripts with different features depending on the novelty of the words (for example: the new or few frequent words will be wrote with a script and/or in a different color); the graphical form is composed of pictures that represent the story read from the child in the its different scenes.

In the Smart Games Activity, to the child have been proposed more exercises associated to the story read previously. The exercises have allowed to verify the comprehension ability of the reading activity (a) for each story and (b) for the each difficulty level.

In the Relaxing Activity, the child is stimulated with some games on PC that are different from the exercises used in Smart Games Activity. This activity has been inserted in the plan to make

Please cite this article in press as: Giacomo Dina, D., et al. The silent reading supported by adaptive learning technology: Influence in the children outcomes. *Computers in Human Behavior* (2014), http://dx.doi.org/10.1016/j.chb.2014.09.053