The BBC project - Body Based Classrooms

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Abstract. Despite growing strands of evidence indicate that learning processes can be fostered by making learners cognitively and bodily active, too often school considers learners as passive receivers of knowledge and tends to ignore the role of the body, thereby providing disembodied and too abstract teaching methods. We present a project in which experimental evidence on embodied cognition and active learning is used to devise a training for learning from text in primary school children. The evidence-based training, which exploits body and sensorimotor information, involves learning of information technology and can be easily incorporated into teaching settings and procedures. Both learning in presence and distant learning in Covid era can benefit from bringing the body back into the learning process.

Keywords: Active learning, Body, Cooperation, Text comprehension, Information technology, Primary School

1   Introduction

Psychological and neuroscientific studies highlight relevance of active learning (e.g., [1]). Metcalfe and Kornell's [2] study is one of the most representative. The task of the participants was first to learn a series of words (targets) associated with their definitions (e.g., "negotiate": discuss with someone to reach an agreement). Later on, in the second phase of the experiment, they were assigned to two groups. Group 1 simply re-read the word to be learnt (target) along with the definition, both for 6 seconds, whereas for Group 2 the target word appeared only after 3 seconds from the definition appearance. Hence Group 2, compared to Group 1, received the correct information (target + definition) for a shorter period (3 seconds). However, as the results revealed, Group 2 outperformed Group 1 on a subsequent learning test. A plausible interpretation is that participants in Group 2, during the 3 seconds of delay between definition and target word, generated the desired learning by themselves. This simple experiment shows that the mere and passive reception of contents is not an effective method to foster knowledge construction. Hence, making learners cognitively active should be a main goal of good learning practices.

Initially, active learning was exclusively conceived in cognitive terms. For instance, studies revealed that being forced to draw inferences while reading a text, as compared to a passive reading condition, improves comprehension and learning from text as well

as reading motivation [3]. Further, interacting with peers having different perspectives [4,5] is an active and effective method to improve learning processes: the cognitive conflict experienced by learners enhances their falsification ability, which is central to reasoning and learning.

More recently, several studies have pointed out that mind and body are not two ontologically distinct entities: they influence and intertwine each other. On this line of argumentation, those studies have suggested that learning may benefit also from active bodily involvement. Memory traces underlying learning should be understood in terms of "sensorimotor encoding": they store information on the neural states underpinning the perception of our body and our movements [6]. In this perspective, learning and memorization processes take place *through* the body. Learning consists in creating mental simulations that contain bodily format information stored in modality-specific brain regions, and memory is tantamount to a covert re-enactment of these sensory and motor states [7]. Consistent with this theoretical framework, it is possible to foster learning by reinforcing bodily and sensorimotor information at encoding. For instance, simple movements of arms and hands may have beneficial effects in several domains, such as narrative [8] and scientific texts comprehension [9], math abilities [10], and even foreign languages acquisition [11]. These effects hold also during the retrieval phase [12]: if memories are sensorimotor simulations, then triggering those components at recall should speed up the retrieval processes. Still consistent with the embodied view, the use of body-based strategies may allow young learners to express ideas not yet verbalized [13]. For example, children can express through gestures concepts that they are not yet able to express in words [14]. Conversely, sensorimotor simulations may be blocked by a concurrent task involving the same sensorimotor resources [15,16] or by inhibiting motor areas [17], thereby inhibiting the learning process.

Despite converging evidence on the relevance of body-based practices, the school setting has remained almost unchanged during the 1900s; teaching exploits complex forms of reasoning in too formal and abstract ways [18]. Covid emergency urges a quick reconsideration; distance education limits learner's active role, as well as body use and interactions between peers. If several areas of research point to the importance of using the body in traditional teaching and learning settings, embodied learning may play an even more critical role in distance education. Covid emergency also highlights the necessity to integrate traditional learning settings with new technologies. In line with this consideration, the European Commission works on several policy initiative to modernise education; most relevant, it provides funding to promote digital technologies used for learning and measures the progress on digitization of schools. There is a general agreement on the fact that computer science should be part of general education from the earliest stages to teach young people how the computer works, to introduce them to computer science and to increase thinking skills. In particular, the use of social platforms, besides being relevant to learn to use computers, may be relevant for a twofold reason. First, it allows teachers to easily create and/or share files, videos, and images that promote engagement in the learning process [19] and sensorimotor experiences [20]; second, it enables children possibly remote connected at home to learn actively with teachers' support and to socially construct contents through conversation

with peers [21]. Some platforms more than others seem to facilitate peer communication and allow students to create a group with other children to collaborate at the same project; teachers can monitor the information shared by children and they can communicate them both individually and collectively [e.g., 22,23]

We present a project whose aim is to foster learning from text through active participation, body involvement and the use of computers. In particular, the focus is on learning from history and science texts in third-grade children of primary school.

The project involves the collaboration of the Department of Psychology with the Cooperativa Sociale Terzo Tempo and Istituto Comprensivo Tommaseo of Torino. The school board will allow educators of the cooperative: 1) to initiate co-planning with the teachers involved in the project, 2) to support those teachers in the realization of the project, both in the first and in the second phase of the project. The details of the first phase are described below; the second phase foresees the actualization of the project in several third-grade classes of primary school. Indeed, the project aims at devising a training for effective learning to replicate on a large scale. Further, the development of the project foresees seminars whose aim is twofold: first, to engage parents in their children's learning process, second, to foster a strong school-family alliance favourable to children's wellbeing.

2 Learning from Texts in Body Based Classrooms

A deep comprehension of a text is tantamount to the construction of an articulated mental model [24] or situational model [25] of the text. Readers build such models integrating the information contained in the text, their previous knowledge and all the inferences they draw from the text. The training rests on five main evidence-based assumptions:

1. Readers take advantage from interventions that focus on teaching words meaning, above all of connectives that express causal relationships; they enable learners to construct and organize a cohesive text mental representation [26].
2. Readers benefit from questions designed to prompt causal connections between different parts of the text, such as "How does this sentence relate to something you previously learned in the text?": self-questioning urges readers to adopt an active role in processing text contents thereby favoring reading comprehension [27].
3. Readers who mentally simulate sensory and motor information contained in the text, incorporating them into the mental model achieve a deeper text comprehension [28].
4. Gestures produced during reading favour such mental simulation of the text [29]. Further, gestures at times convey information that are not conveyed in speech thereby revealing unexpressed thoughts.
5. Argumentations (one or more statements that are used to provide support for a conclusion) foster learning: both reasoning and comprehension abilities improve when children may know another person's point of view [30].

General Setting

The subjects of the project are either learners connected in remote from home, or learners physically at school, or both. Teachers and educators create an account on a social platform and organize the classroom page to facilitate children's navigation of webpages. Subsequently, teachers explain to the class how to use the platform and how to share contents, in line with the modules of the project. In this phase, teachers may take the opportunity to teach children how to behave responsibly on online social platforms. Finally, because of the peculiarity of the training, teachers and educators verify that children have the freedom to produce gestures/movements deemed congruent with the text to be learnt, which will be projected on the wall of the children's classroom and displayed on the computer screen for online learners.

Modules 1 and 2: vocabulary knowledge

Module 1: Understanding causal connectives

Children will be trained to actively generate sentences containing causal connectives (e.g., "why", "although", "therefore", "anyway"). To improve generation effect, teachers will create on the social platform one post for each connective and children will be encouraged to comment on these posts with sentences involving the connective and based on their daily activities. In the following modules, whenever they encounter such connectives in the text, children will comment on how the phrase connects with previous parts of the text.

Module 2: Understanding words meaning

The module introduces the meaning of words referring to names and actions that the child will encounter in the following lessons (e.g. chapter of history or science). Teachers and educators will identify the words in the text supposed to be unknown or unfamiliar to the children. Each word will be written on a cardboard, and placed in a jar. Then, every child will randomly pick a cardboard and will be invited to say the meaning. Once the correct meaning will be identified, the teachers will assist children into the construction of plausible phrases containing these words.

Modules from 3 to 8: they apply to each portion of the learned text

Teacher and educator bring out pupils' expectations about the topics that they will have to deal with, highlighting their previous knowledge about these issues. The expectations analysis is important because it shows to learners how the concepts they already possess are linked to those that they will acquire, thereby inducing an active knowledge construction rather than a passive knowledge reception.

Module 3: What I think I know

This module aims at introducing the topics that will be studied in the following lessons. Starting from the reading of titles and paragraphs, children will be invited to say what they know and what they imagine about the topics, making a way to favor the free expression of their thoughts. The teacher, along with the educator, will write on the blackboard and differentiate what is consistent with the addressed topics from what is not related, clarifying the connections with the subject of learning. Teachers will upload a map on the social platform and will encourage children to express their doubts about these concepts and the links between them. Teachers will clarify that any doubt expressed on the social platform should be solved by classmates rather than by themselves; they will just give feedbacks about what is correct and what is wrong. Finally, teachers and pupils will discuss together to verify that all doubts are dissolved.

Module 4: Let's do detectives

In this module, children will be asked to pretend they are detectives looking for clues: they need to find hints about what they already know in the text.

Module 5: Let's make a mental movie

Starting from the reading of the single concepts, children will be encouraged to mentally simulate the states of affairs described in the text. This will be presented as a training to personify "the film director", where they will be asked to use their senses to create a mental movie of the events described, as if they were the movie's character. In this way, children will learn to use multisensory experiences to build a mental simulation able to facilitate deep text comprehension. Subsequently, children will be encouraged to share their mental movie on the social platform to favor peer interaction about their sensorimotor experiences. In this way, children could re-experience sensorimotor features starting from different points of views.

Module 6: Embodying concepts

Children will be invited to represent with gestures and body movements the concepts in the text. Each child will be invited to individually read portions of text many times and to accompany reading with gestures and movements congruent with the concepts in the text. Children should feel free to take the time they need to complete the task.

Module 7: Take care of steps

To favor a deep processing of the text, children will be invited to make inferences about the learnt concepts at the end of each mini paragraph. Furthermore, in order to facilitate comprehension of the links between learned concepts and those contained in the next paragraph, teachers will provide a series of verbal clues that make explicit the main concepts that they will have to deal with on the social platform. Before the beginning of the new paragraph, children will be encouraged to write down what they know and what they imagine about these concepts, and their possible links with what has been

previously learned. In this way, children will produce the content to learn by themselves, drawing a series of knowledge-based and text-based inferences.

Module 8: Let's put pieces together!

Children actively co-participate in making a written summary of the text. Children will utilize the social platform to cooperate in the construction of the meaning of the text. A child will generate the first sentence of the summary; then another child will generate the second sentence starting from the first, and so on until children believe that the summary will be complete. At the end, teachers will verify the correctness of the summary and will discuss with children regarding the wrong concepts.

Experimental validation of the training

The assumption according to which our training may improve learning abilities will be experimentally validated. Two third-grade classes will participate in the validation process. While studying the same text, one class will participate in the critical training (experimental group) whereas the other class will receive school's regular instructions (control group). The two classes will be randomly assigned to the experimental and the control groups. At the end of the training phase, both groups will be tested to evaluate their knowledge about the studied text. Further, the validation foresees a pretest-posttest control group design: 2 weeks before and after the training, both groups will be tested for their ability to learn from a text; we shall use two texts concerning the same school subject (e.g., history or science). This procedure will enable us to ascertain whether our training may have a beneficial effect on the ability to learn from a text (the process involved in knowledge construction), rather than just on the acquisition of text contents.

3   Conclusions

School can do more and better in making learners active and deeply involved in the learning process. The Covid emergency forces us to rethink the school learning process urgently. In the light of scientific evidence, we have developed a training for learning from school texts. The training was developed for third graders and is feasible both in case some pupils of a class are physically present in the classroom and others remotely connected via computer. Its relevance relies in making pupils active also through bodily involvement and use of information technology.

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