A Territorial Learning Ecosystem for Parents’ Participation and Cooperation

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Abstract Parents are critical to student attainment and learning. It is therefore key to foster their active participation in their children’s education and provide them with tools to be effective. This paper describes the implementation of a territorial learning ecosystem that provides K12 parents with the facilities to support their children’s learning at home, track progress against the national curriculum, and network and share their experience with other parents. The territorial learning ecosystem includes an interactive map of the country. This map displays indicators of the level of overall activity in the subject, as well as in each of the specific learning objectives defined by the national curriculum. The ecosystem provides indicators at four different levels: region, district, school, and classroom. During the second semester of 2019, a total of 1235 first grade classes voluntarily adopted the system. In mid-October, educational videos made by parents were uploaded to the system, in which they shared examples of homemade activities and teaching strategies. 98 schools from the most populated region submitted 98 parent-made videos to be shared during a public event. 82% of the videos showed a mother with her child learning to read or write, 49% showed word segmentation activities, 48% showed homemade educational games, and 26% showed activities using glove puppets. Experts rated the communication and educational quality of the videos. We found that a much higher proportion of videos involving glove puppets were rated as “very good” when compared to the other types.

Keywords Territorial ecosystem · Supportive technologies · Social innovation

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1 Introduction

1.1 Parental Participation

Parents are critical for improving students’ attainment and learning outcomes. In the primary years, family influences have a more powerful effect on children’s attainment and progress than school factors. At age 7, parent effects explain 29% of the variance in attainment, while school effects explain only 5% of the variance [1]. Therefore, foster their active participation in their children’s learning is key. On the other hand, parents of the lowest socioeconomic status (SES) segments, on average, have much lower expectations of attainment than other parents [2, 3]. Therefore, it is particularly important to devise ways to engage low SES parents.

However, parents do not have effective strategies for supporting learning at home. Furthermore, such strategies are very difficult to discover or learn independently. First, there are two rival strategies for teaching reading that have been causing a pedagogic dispute for nearly a century, the so-called reading wars. While one of them is effective according to empirical evidence, many teachers and parents inadvertently use the wrong strategy or an inefficient mix of the two. Second, parents do not have the time nor the training to search for empirical evidence. Third, some books recommend several strategies but it is not clear how to implement said strategies. For example, Willingham [4] encourages parents at home to adopt strategies such as talking and asking specific questions about what happened in the classroom, reading more non-fiction texts aloud to the child, and playing games, such as board games or homemade games. However, the problem is that identifying effective games or types of books based on the child’s gender and interests is not a simple task.

1.2 The Secret Is Collective Brains

The challenge is identifying strategies that help parents of elementary school students to contribute to their children’s learning. We propose an ecosystem to foster parental participation, sharing and cooperation. Since we are social animals with particularly powerful adaptations that help us learn from others, it is, therefore, important to facilitate that type of learning. According to Sloman et al. [5], individual intelligence is overrated, and in the real world nobody operates in a vacuum; we work in teams, and we let our group to do our thinking for us. There is growing empirical evidence on the power of learning in communities. For example, after studying different hunter-gatherer societies all over the world, Henrich [6] concluded that larger and more interconnected groups generate more tools, expanded bodies of know-how, and fancier techniques. If the community is very small, it can experience the “Tasmania effect.” This is a regression that occurred in Tasmania. As the size of the community was reduced 12,000 years ago as a result of rising sea levels that cut
them off from Australia, the aborigines were losing their know-how to make tools, weapons, clothing and boats, and going back to more primitive cultural tools.

Humans are cultural animals, animals that have evolved through natural selection to participate in a community, where individuals not only relate to each other as individuals but are also shaped by their social network [7]. Our societies and social networks act as collective brains [8], where individuals selectively transmit and learn ideas that can produce complex solutions without the need for a designer. We therefore explore the effect on parents of using technology to connect parents and teachers in a learning community that collaborates in order to improve the children’s learning.

2 The Evolutionary Mechanism for Learning

2.1 Imitation

One critical mechanism for learning is imitation. This mechanism is widely present throughout the animal kingdom and is an essential force for animal and human societies [9]. Imitation is a key component of cultural transmission. It is favored in relatively stable environments, when the error rate associated with it is lower than the error rate associated with individual learning. A learning ecosystem should therefore help parents imitate strategies that have already been implemented by other parents.

Once parents start imitating the strategies and ideas, then we have to consider that copies are not completely identical to the originals. Mutations invariably occur and therefore new strategies naturally begin to appear. Inevitably, a process of recombination of ideas also starts to emerge at the same time. As Ridley [10] describes it, ideas start having sex with each other. This is the engine of human progress: mating of ideas to make new ideas [10]. Thus, it is critical that a learning ecosystem promotes and fosters the sharing and exchanging of didactic strategies, games, and tools. This is the basic mechanism for social innovation.

The whole process is a typical evolutionary mechanism, but it needs to start from an initial population of strategies [11]. This initial set of strategies and ideas will jumpstart an iterative process. Therefore, the learning ecosystem must also provide an initial set of strategies. The population of strategies in each iteration is called a generation. In each generation, the fitness of every strategy needs to be somehow evaluated. This is a critical step to ensure the emergence of more effective strategies. These are strategies that are both highly motivating to young children and at the same time effectively help their learning. This means parents need to have feedback on the strategies, and so a learning ecosystem must provide clear metrics that help them assess the effect of their strategies.
2.2 The First Generation of Strategies

What are the initial ideas provided by the learning ecosystem? The system provides three types of strategies. The first strategy proposed is play. This is suggested together with different didactic games. This is considered one of the key tools to be imitated at home. It is very powerful since play is an ecologically valid educational strategy used by mammals and several other animals [12]. Mother–offspring play among humans and non-human primates is widespread and central to offspring development. Indeed, such play has structural similarities across these species, like exaggerated movements and self-handicapped (slower and weaker) behavior of adults to facilitate offspring learning. Play is proposed through games, such as using dice with letters to challenge the child to form words and, eventually, sentences. Other games propose using whistles to help separate the different sounds in a word.

A second strategy proposed is the use of glove puppets or imaginary companions. Children are frequently exposed to anthropomorphic books, TV shows, and narratives. They are used to play with non-living objects, such as hand puppets and stuffed toys, and perceive them to be agents that are worthy of social interaction [13]. Imaginary friends are used by 67% of children [14]. Several studies suggest [14] that having an imaginary friend confers a developmental advantage in a number of important sociocognitive areas. Children with imaginary friends produced a range of more complex sentence types in a narrative task than children in a control group [15]. They produced significantly more adverbial clauses, relative clauses, and compound sentences, where clauses were connected using “and” or “but.” Using glove puppets as a tool for learning at home is therefore a reasonable strategy. If it is their own favorite glove puppet then the effect can be increased, since young children are less likely to accept an identical replacement for an attachment object than for a favorite toy [16]. This may be due to the fact that children believe that their favorite toy or puppet has a hidden and invisible property that distinguishes it from everything else.

Play and glove puppets can facilitate the development of powerful cognitive strategies in children, such as role-reversal imitation and transmission chains, in which children learn something and then teach another child [17]. However, in this case, the child instructs their glove puppet. This in turn facilitates the internalization process, where a child not only follows instructions but also self-regulates their own problem-solving activities and instructs themselves.

A third strategy proposed is using coloring books with instructions on how to color. This strategy is particularly recommended for fostering reading comprehension. It starts with simple instructions to color one of the objects shown on the page, such as “color the piano blue.” Throughout the book, there is a sequence of coloring activities that become increasingly more complex. For example, instructions with existential quantifiers, such as “in each box, color at least two balls blue,” printed on a page depicting several boxes, each containing several balls. A more complex set of instructions is given in a series of sentences articulated by different characters shown on the page. Each of them gives certain hints about the location of where a
particular object is hidden. Connecting the sentences, the reader should be able to infer where the object is hidden and color its location.

### 2.3 The Territorial Component

In-group favoritism and ethnocentrism are human universals [18]. Humans are innately tribal. Experiments with children, adults, and even monkeys with reaction time tests reveal negative associations with out-group members. However, markers can be created flexibly, extending beyond language, ethnicity or even race [19]. This powerful social force has been recognized in different ways since ancient times. For example, a related concept is cohesion, asabiyyah [20], or social solidarity. They emphasize group consciousness and a sense of shared purpose. One powerful group-marker is territory. Capello [21] highlights that territorial identity is rooted in similarity and solidarity, which form the basis of identity. Therefore, a powerful learning ecosystem should include territorial facilities that use the in-group mechanism that fosters sharing and collaboration between parents from the same district.

### 3 Implementation

During the second semester of 2019, a total of 1235 low socioeconomic status (SES) Chilean schools voluntarily adopted ConectaIdeas Express, a smartphone-based support system, in order to help teach first graders how to read [22, 23]. At the end of the semester, the app was being used by almost 50% of schools that were effectively using the Ministry of Education’s official textbook for teaching reading. From these schools, 988 teachers used the app to assess 30,158 students in 1022 first grade classes. Teachers used exit tickets in order to assess their students. These one-question tickets correspond to formative assessments that allow teachers to quickly know how well their students understand the material they are learning. For this reason, toward the end of the session, students answered the exit ticket orally or in writing. Later, each teacher inputted the information into their smartphone. The tickets were designed by the Ministry of Education and shown in the textbook. Each ticket is associated with a specific learning objective (LO) on the national curriculum.

Most of the schools that adopted the app serve a population of low SES students from all over the country. They represent 15% of the country’s students at that grade level. Most of the schools have poor technological infrastructure and unreliable Internet, particularly rural schools. All training was done during the second semester via a weekly email with tips on how to install and use the app, as well as links to one-minute videos. On average, each teacher used the app for 22 sessions. This means that it was used approximately twice a week.

The territorial learning ecosystem was implemented as a geographic information system, with maps showing the activity by region, district, and classroom. All the
Fig. 1  Screenshot with the map of the country showing the average number of questions answered per class in each region of the country. Darker regions mean a higher number of questions per class. To the right is the list of regions with the average number of questions answered by each class.

Information on every class was shown in the territorial learning ecosystem for the whole country (Fig. 1), with statistics on curriculum coverage per region. At the country level, an interactive map shows the average number of questions answered per class in each region of the country.

Each parent can access the map and zoom into any region (Fig. 2). In each region, different districts are shown with their own activity indicators. Darker zones correspond to districts where more tickets have been completed per class.

Any parent can zoom into a district and see all of the schools and classes in that district. Black dots are schools without first grade (Fig. 3). White dots are schools not in the Ministry program. The cell phone icons are schools using ConectaIdeas Express. Red cell phones are classes where parents have produced a video and the teachers have uploaded it to the system.

If the user clicks on the smartphone the information on the class is displayed, along with the number of tickets and curriculum coverage (Fig. 4). Moreover, if the smartphone is red it means that there is a parent-made video that has been uploaded for at least one class at that school. In this case, the video is shown to the left of the screen (Fig. 4).

Parents can access all of the maps from their smartphones and share them through WhatsApp. While the territorial learning ecosystem can also be accessed via the Web, parents tend to prefer the mobile version.

In order to assess the impact of the territorial learning ecosystem on parents and the quality of their videos and interventions, 170 schools from the metropolitan region were invited to a breakfast to share experiences and submit one parent-made video per class. The breakfast was held near the end of the semester, on October 11.
**Fig. 2** Screenshot with map of the metropolitan region showing the average number of questions answered per class in each district of the region. Darker districts mean a higher number of questions per class. To the right is the list of districts in this region with the average number of questions answered by each class.

**Fig. 3** Screenshot with a map of the Lo Prado district in the metropolitan region showing the average number of questions answered per class at each of the schools in the district. To the right is the list of schools in the district with the average number of questions answered by each class.
Fig. 4  Screenshot with parent-made video displayed to the left of the screen after clicking on one of the red smartphones on the map. Information on individual students is never displayed.

Parents had access to a set of initial videos showing two of the three different strategies mentioned previously: play and hand puppets. The coloring book strategy was proposed later on in November and its impact is not analyzed here. Therefore, only two kind of strategies are included in the videos from the initial generation that jumpstarts the evolutionary mechanism.

4 Results

Ninety-eight schools from the metropolitan region sent their parent-made videos. This is then the second generation of didactic videos. A team of four independent teachers watched the videos in order to detect the presence of different features. Some of these features and the frequencies with which they were detected can be found in Table 1. The most frequent strategy was videos showing a mother with their

| Table 1  Parent-made didactic videos uploaded to the territorial learning system |
|---------------------------------|-----------------------------------------------|
| Percentage (%)                  | Description                                |
| 82                              | Videos showing a mother with their child    |
| 49                              | Videos of word segmentation activities      |
| 48                              | Videos showing play with didactic homemade games |
| 26                              | Videos showing glove puppets                |
| 13                              | Videos showing magic boxes                  |
| 9                               | Videos showing more than one child          |
| 8                               | Videos showing whistles                     |
| 3                               | Videos showing didactic dice                |
child (Table 1). Videos of word segmentation activities and with homemade games were also frequent.

An independent, experienced teacher and a video communication expert rated each video based on its didactic value (i.e., whether or not it promoted validated teaching strategies) and its communication quality (i.e., whether or not it was engaging and easy to understand and replicate). The videos were rated using a three-level system: unsatisfactory, satisfactory, and very good.

- 5% of the videos were rated as unsatisfactory
- 30% of the videos were rated as satisfactory
- 65% of the videos were rated as very good.

We found that some features are more frequent among very good videos. Conversely, we also found that the proportion of very good videos is much lower when the videos do not have these features. More specifically, we found that:

- 94% of videos involving a didactic game are rated as very good, versus 41% of videos without didactic games.
- 96% of videos involving glove puppets are rated as very good, versus 56% of videos without glove puppets.
- 88% of word segmentation videos are rated as very good, versus 46% of videos without word segmentation.
- 75% of videos showing a mother and their child together are rated as very good, versus 28% of videos not showing the two of them.
- Additionally, we found that 91% of videos without glove puppets but involving a game are rated as very good. Conversely, only 40% of videos without a glove puppet or a game are rated as very good.
- Moreover, 51% of videos without a glove puppet or a game but that show a mother and their child together are rated as very good, versus only 13% of videos where all three of these features are missing.

We ran a decision tree classification algorithm in order to get better insights into what combinations of features make a good video.

Figure 5 shows the resulting decision tree that classifies the videos into two categories: very good and not very good. The most discriminatory variable according to the Kolmogorov-Smirnov (KS) metric is the presence of a glove puppet. Virtually all (96%) videos with glove puppets are rated as very good. In those without glove puppets, the variable indicating the presence of a didactic game is the one that best discriminates. If there is a didactic game, then 91% of the videos are very good. If not, then the variable indicating the presence of a mother and their child in the video is the one that best discriminates. If mother and child are present in the video, then 51.4% of the videos are very good. If they are not, then only 13.3% of the videos are very good.

In summary, a recommendation for parent-made videos is to show the mother and offspring playing a didactic game together and using a glove puppet.

The analysis of the videos was carried out in January 2020 during the school summer holidays (January and February). In April 2020, a Web book with all of
the videos was published for parents, highlighting the ideas or strategies included in each one (Fig. 6). During April and May, the Web book and videos are being sent to parents and teachers. The Ministry of Education continued with the application of the system in 2020, while the Web book and video are currently being used by teachers and parents for home-based activities to foster reading instruction during the schools closures caused by the COVID-19 pandemic.

5 Conclusions

According to a recent 2019 OECD report [24], pedagogical innovation among OECD nations has been moderate at the system level. The biggest innovations have been seen in independent knowledge acquisition and homework practices, followed by both rote learning and active learning practices. The report concludes that in order to produce good results, good pedagogical practices must be supported. Given this trend toward homework practices and the importance of the effect of parents, it is then critical to disseminate effective teaching strategies for home use. In particular, these should be strategies that foster collective brains that connect with each other in order to explore, test, imitate, improve, and recombine strategies, and thus discover new effective strategies. In this paper, we have described the implementation of a territorial learning ecosystem that provides K12 parents with the facilities to support their children’s learning at home, track the class progress according to the national curriculum, and network and share their experience with other parents.
The plan was to create a community and an ecosystem that fostered parent learning using an evolutionary mechanism for the transmission and improvement of strategies. Starting with a population of a first generation of videos with initial teaching strategies, the participation of parents was encouraged by imitating the videos, sharing them, exchanging ideas, and adjusting them based on their own needs.

The territorial learning ecosystem also promotes territorial motivations. It includes an interactive map of the country, which displays indicators of the level of overall activity in the subject, as well as in each of the specific learning objectives defined by the national curriculum. The ecosystem displays indicators at four different levels: region, district, school, and classroom. During the second semester of 2019, a total of 1235 first grade classes voluntarily adopted the system. In mid-October, educational videos made by parents began to be uploaded to the system. Through these videos, parents were able to share their own homemade activities and teaching strategies. 98 schools from the most populated region submitted parent-made videos for sharing at a public event. 82% of the videos showed a mother with her child learning to read or write, 49% showed word segmentation activities, 48% showed homemade educational games, and 26% showed activities involving glove puppets. Experts rated the communication and educational quality of the videos. We found that a
much higher proportion of videos involving a mother and their child playing a game with a glove puppet were rated as "very good."

This year, the system is being applied by the Ministry of Education for all first and second graders. This will give us the opportunity to observe new generations of videos, strategies, games, and materials, as well as to verify whether the degree of enthusiasm and participation among parents persists and extends to other subjects.

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