The state of the art of school gardens as a pedagogical tool for the new environmental rationale paradigm in Butanta, Sao Paulo, Brazil

O estado da arte dos jardins escolares como ferramenta pedagógica para o novo paradigma racional ambiental de Butanta, São Paulo, Brasil

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ABSTRACT
The search for an environmental rationality guided by sustainability configures not only an opposition to the predatory appropriation of nature, but is presented as an alternative perspective that seeks quality of life to human communities and the guarantee of equity in access to natural resources. Respecting the locally constructed knowledge based on territoriality is central, highlighting the role of traditional cultures as sources of plurality in environmental discourses and practices. Encompassing multiple techniques, stories and conceptions, working the land has been a constant throughout different cultures dealing with nature. Given the Sustainable Development Goals on food security and quality education, growing school gardens is an important strategy towards a more healthy social reappropriation.
of nature. In this context, the present research aims to identify the variety of knowledge constructed by school agents during the processes of implementation, maintenance and didactic usage of school gardens in 15 municipal schools of Butantã Regional Board of Education (Sao Paulo, SP). Methodological design comprised quantitative and qualitative approaches. Closed questionnaires were responded by 88 teachers, 15 pedagogical coordinators, 52 employees (outsourced and administrative) and 47 students, and qualitative data came from 11 semi-structured interviews. Analyses and discussions were conducted separately across the steps of implementation, maintenance and usage, and were based in six thematic axes, constituting thematic categories defined a posteriori: “financial resources”, “human resources and school staff integration”, “external relations”, “environmental restraints”, “initial and continuing education” and “didactic potential perception”. Human resources and school staff integration and financial resources appear as the main difficulties through the analysed steps. There is a demand for specific training in working with the school garden, specially regarding the didactical usage. Considering the environmental restraints, the access to quality soil imposes the main obstacle in maintaining the garden. In spite of the difficulties, there was a general perception of positive effects of garden usage on students, both in behavioural and pedagogical aspects, as well as the potential for improving learning conditions at the school as a whole.

**Keywords:** school gardens, education, sustainability, sustainable schools, public administration

**RESUMO**

A busca de uma racionalidade ambiental pautada na sustentabilidade configura não apenas uma oposição à apropriação predatória da natureza, mas é apresentada como uma perspectiva alternativa que busca qualidade de vida para as comunidades humanas e garantia de equidade no acesso aos recursos naturais. Respeitar o conhecimento construído localmente com base na territorialidade é central, destacando o papel das culturas tradicionais como fontes de pluralidade nos discursos e práticas ambientais. Abrangendo várias técnicas, histórias e concepções, trabalhar a terra tem sido uma constante em diferentes culturas que lidam com a natureza. Dados os Objetivos de Desenvolvimento Sustentável sobre segurança alimentar e educação de qualidade, o cultivo de hortas escolares é uma estratégia importante para uma reapropriação social mais saudável da natureza. Nesse contexto, a presente pesquisa tem como objetivo identificar a variedade de conhecimentos construídos pelos agentes escolares durante os processos de implementação, manutenção e uso didático de hortas escolares em 15 escolas municipais da Diretoria Regional de Educação do Butantã (São Paulo, SP). O desenho metodológico compreendeu abordagens quantitativas e qualitativas. Os questionários fechados foram respondidos por 88 professores, 15 coordenadores pedagógicos, 52 funcionários (terceirizados e administrativos) e 47 alunos, e os dados qualitativos vieram de 11 entrevistas semiestruturadas. As análises e discussões foram realizadas separadamente nas etapas de implementação, manutenção e uso e foram baseadas em seis eixos temáticos, constituindo categorias temáticas definidas a posteriori: “recursos financeiros”, “recursos humanos e integração de funcionários da escola”, “relações externas”, “Restrições ambientais”, “educação inicial e continuada” e “percepção potencial didática”. A integração de recursos humanos e funcionários da escola e os recursos financeiros aparecem como principais dificuldades nas etapas analisadas. Há uma demanda por treinamento específico no trabalho com a horta escolar, especialmente no que se refere ao uso didático. Considerando as restrições ambientais, o acesso ao solo de qualidade impõe o principal obstáculo à manutenção do jardim. Apesar das dificuldades, houve uma percepção geral dos efeitos positivos do uso...
do jardim nos alunos, tanto em aspectos comportamentais quanto pedagógicos, bem como o potencial para melhorar as condições de aprendizagem na escola como um todo.

**Palavras-chave:** hortas escolares, educação, sustentabilidade, escolas sustentáveis, administração pública.

1 INTRODUCTION

1.1 CONTEXT

In face of the current social and environmental crisis, the constitution of a new *Environmental Rationale* (LEFF, 2002) brings up discussions about the reciprocity between education and society. Despite the context of rising perceptions of the environmental crisis over the last five decades and its consequences on social and political transformations, schools still play a relevant role in the establishment of values, signs and meanings, given schooling as a Social Fact (DURKHEIM, 2008). Thus, the means of school production and social reproduction are still based on the relations between them, especially since coming from socially dominant classes (BOURDIEU, 2004). In this way, looking from an emancipatory perspective on education, Patto (1991) points out the permanency of school failure in Brazil, closely related to this reciprocity system between the reproduction of school and social patterns. According to Tragtenberg (2004), such permanency is evidenced not as an actual failure, but as a well established — and successful — political project by the State to use schooling as a way of maintaining social production relations. According to this author, this conservative approach to pedagogical action becomes evident when you look at, among other things, the inculcation of school rules, which are the first steps for learning social production relations, and in the duality between intellectual and manual work, the roots of *School Separation*:

> School separation is a key factor in determining the roles in the social fabric (...). This is due to the separation between manual and intellectual work, between theory and practice. All scholarization is conservative by nature, because it legitimizes separation between consciousness and practice. (TRAGTENBERG, 2004, p. 52, free translation)

Given the discussions about authoritarianism in schools (as posed by Foucault, 1987) and occult curriculum (ARAÚJO, 2018) in the establishment of school rules, the very constitution of teacher knowledge relates to school separation. In this sense, Tardiff (2000) points out that, in teachers’ initial education, there is an applicationist model,
“knowing and making are dissociated and treated separately in distinct and unintegrated formation modules” (TARDIFF, 2000, p. 19, free translation). According to the author, this model is also observed throughout teachers’ careers, both through interactions between different types of teachers’ knowledge and the products of the developed pedagogical activities.

Bizerra and Ursi (2014) point out that there are four types of teacher’s knowledge: pedagogical (conceptions of teacher practice), disciplinary (related to formation fields), curricular (associated to school programmes) and experiential (related to teacher practical experience, not only in cognitive mechanisms but also in the relationships built). These types of knowledge are in constant interaction, orienting pedagogical actions. In this way, the prevalence of the demand, from specific sectors of civil society, for disciplinary knowledge in detriment of the others, strengthens the applicationist model of teaching, through the technician-teacher profile. This teaching-learning process is once more related to school separation, since it’s designed under the same dichotomy between knowing and making and considers schooling as a unidirectional transmission of disciplinary knowledge.

This kind of linear logic, disconnected from territory, in which strictly technocratic perspectives have been shaping conceptions of education and environment, is present and reaffirmed both in teaching careers and in curriculum learning goals, by ignoring experiential knowledge and not integrating it to the other three types, as well as not considering teachers’ own reflections over their practices. To Max-Neef (2005), such linear and simplified rationale is inefficient in dealing with the complexity of the world we live in, where non-linear processes were already related to a plethora of science fields:

Systemic visions have brought about the demise of the assumptions that Nature can be described, analyzed and controlled in simple terms that correlate with a traditional linear logic. All these new concepts [complexity, chaos and non-linear processes] have revolutionized many ambits of the basic sciences. However no significant break-through is to be found when it comes to disciplines related to social action, economics and politics (MAX-NEEF, 2005, p. 14)

Therefore, educational actions, especially for sustainability, must not be seen as static, but based on the premise of plurality of knowledge, locally inserted, and in dialog with the many social actors within a territory. The formation of a new Environmental Rationale for education and sustainability must, thereby, consider an episteme guided by the complexity of
actors and interactions actively transforming their environment. Pedagogical action for sustainability is, thus, presented in opposition to the strictly technocratic thinking which has governed environmental rationale throughout the 20th century (LEFF, 2002) as well as the standard educational system.

1.2 THE TRANSITION TOWARDS SUSTAINABILITY AND PEDAGOGICAL ACTION

In view of the transition towards sustainability, relevant educational assertions were made in the last decade. Atop the 11th United Nations Goals for Sustainable Development (GSD-UN), which proposes to “Make cities and human settlements inclusive, safe, resilient and sustainable” (GSD-UN, 2015, goal 11), Sao Paulo’s Strategic Guide Plan (which refers to municipal law for territory management, SÃO PAULO, 2014), underscoring revision of Soil Subdivision and Usage Law, stresses out the role of health and educational institutions at “(...) occupying areas or blocks in their surroundings with the objective of regulating, renovating and building complementary units to those installed within their areas.” (SÃO PAULO, 2014, item XLIV, art 27, section I; free translation). The transversality among educational action, territoriality and sustainability is, therefore, acknowledged.

This kind of capillarization of public institutions throughout the territory is the first step at entrenching the Right to the City (as posed by New Urban Agenda proposed in 2016 at United Nations Conference on Housing and Sustainable Urban Development - Habitat III). Such process not only contemplates the articulation between the many instances of public administration, it also guarantees to communities the social endeavours it adopts. Furthermore, Sao Paulo’s City Curriculum (SÃO PAULO, 2017) aims for the formation of active and critical citizens, capable of practicing democracy through the engagement on relevant challenges of human settlements, leading towards active individual involvement and, hence, towards materializing the Right to the City. The perspective on Integral Education presented at City Curriculum seems to contemplate this issue: beyond the sense of full-time education, individual’s holistic formation must foster the development of abilities, attitudes and concepts from perspectives that are both integrated between different knowledge fields and integrative of territory particularities where pedagogical actions take place (GALLO, 1990).

Those objectives are in agreement with what is posed by authors like Motokane et al (2010), pointing out that “the learning of contents (concepts, methodologies and attitudes) from different natural science fields is important for the student to comprehend complex phenomena present in daily life” (MOTOKANE et al, 2010, p. 50, free translation) such as
local socio-environmental challenges. It is underscored, then, that the diversity of knowledge produced within territories, pivoted with scholar and schooling knowledge, enriches knowledge-building and represents important advances on the constitution of a new Environmental Rationale. Thusly, the relevance of diversifying the associations and experiences with other institutions is also pointed out (SÃO PAULO, 2017, p 21).

The many discourses on sustainability assume, in educational action, multiple forms, according to political, economical and social problematics in which they might be found. Given school separation as a political problematic, it is posed in this study that school gardens are a pedagogical tool (DESMOND et al, 2004) capable of fracturing the separation logic by articulating manual and intellectual work. Besides that, they might foster the application of a wide range of educational strategies, such as learning by doing, problem based learning, contextualized learning and student centered learning (DESMOND et al, 2004). It also allows the development of activities on social and environmental sustainability, which may (but not necessarily) adopt the many perspectives of Environmental Education (EE). Sauvé (2010) stresses out the plurality of lines of thought and conceptions of EE in scholar studies and the particularities in their proposed guidelines for education. Despite this variety, considering the exposed complexity of the social and environmental crisis, the premise of knowledge articulation on education for sustainability is a consensus. Diversity and cooperation are, thus, central in facing this crisis.

In this regard, the perspective of transdisciplinarity (MAX-NEEF, 2005) in educational action for the environment is adopted in this publication. Indeed, transdisciplinary guidelines are present in Sao Paulo's Elementary and Middle School Curriculum (SÃO PAULO, 2017) and in the Common National Curriculum Base (CNCB, BRASIL, 2017), as thematic axis in the former and as transversal axis in the latter — even though their definitions are more closely related to the interdisciplinarity concept, as posed by Max-Neef (2005), than the adopted concept of transdisciplinarity. In the CNCB for elementary school, the fields of experience concept is recommended, even though wider than the strict concept of disciplinarity. Both legislations are in agreement with the transversality principle of EE present in the National Policy of Environmental Education (BRASIL, 1999) and in the Curricular National Directive for Environmental Education (BRASIL, Resolution n2, Conselho Nacional de Educação, 2012). Ergo, it is within reason to conclude that there is a wide legal apparatus (at federal and local jurisdictions) arguing for an integrated path to educational action for sustainability.
Stemming from the strengthening of transdisciplinarity approaches for EE, there is a high potentiality for places and activities to integrate teaching workforce into planning more collective educative actions and integrating different school actors. Given that the school garden is a pedagogical tool, utilizing this space allows teachers to enhance transdisciplinarity in schools through activities that articulate different knowledge fields.

Associated with the plurality of educational action for sustainability, Sauvé (2010) points out the diversity of pedagogical objectives in each EE line. This diversity of objectives has been assessed in several studies which highlight a plethora of gains from engaging in EE activities, both in outdoor classes and in school gardens. It is convenient to quote those related to affective and cognitive gains (PLAKA & SKANAVIS, 2016; BLAIR, 2009), changes in environmental perception (BOGNER & WISEMAN, 2004; PLAKA & SKANAVIS, 2016), increase in cooperation among students and youth protagonism (ROBINSON & ZAJICEK, 2005; BLAIR, 2009; PEREIRA et al, 2012; SANTANA & SANTOS, 2016) and the empowerment related to democratic skills (CHAWLA & CUSHING, 2007). In this perspective, engaging in educational activities for sustainability in school gardens has proven an effective strategy for strengthening schooling for active citizenship, proposed in the city curriculum goals.

1.3 CHALLENGES AND PERSPECTIVES ON THE IMPLEMENTATION OF SUSTAINABILITY PROJECTS IN SCHOOLS

It is important to note that persistent challenges in the implementation of sustainability projects in schools are recurrent in academic literature. The need for human (OZER, 2007) and financial resources (AZUMA et al, 2001; OZER, 2007; PLAKA & SKANAVIS, 2012), the troubles at articulating students’ parents and local community (LANGHOUT et al, 2002), teachers overloaded with projects (AZUMA et al, 2001, OZER, 2007), physical limitations (like soil quality), the demand for continuing education on pedagogical use of the school garden (GRAHAM et al, 2005) and the lack of perception of environmental issues among school staff members (EVANGELISTA & VITAL, 2013) are reported as some of the main setbacks to implementing projects on environmental themes, especially in school gardens.

On the other hand, more recent experiences have found different alternatives to cope with the reported challenges. Both the articulation of different school staff members (AZUMA et al, 2001; OZER, 2007) and institutional partnerships make Environmental Education practices easier in schools (MACHADO & BRANDÃO, 2017). Thus, not only with
continuous financing, but also with continuing education (on school garden maintenance and pedagogical use with a transdisciplinary approach), the role of articulations between the different sections of municipal administration is highlighted, given the complexity of educational action for the environment.

In addition, as a way to address soil quality and physical space limitations, occupying other public spaces (parks, squares, school’s surroundings) broadens the schools’ influence to include urban planning, as proposed in the PDE-SP. By occupying such spaces, those kinds of limitations are surpassed and schools’ actions gain visibility within the territory, strengthening their relations with the local community. Beyond expanding the schools’ social impact, this may contribute to diminish the demand for human resources.

1.4 ASSESSING SCHOOL GARDENS IN SAO PAULO, BRAZIL.

According to the discussed literature, school gardens are a strategic pedagogical tool for educating future generations to be more conscious about social and environmental sustainability. It allows the development of transdisciplinary activities (under Environmental Education perspectives or not) and may provide affective and cognitive gains. It might strengthen the relations between different members of the school community, between the school and other institutional partners, and even broaden its reach beyond its walls, by sharing knowledge with the local community. Therefore, it reinforces schools as pivotal spaces in an educative territory.

It must be pointed out that the research presented in this paper, in spite of being accomplished during Grad School in Biological Sciences and in Geography, draws far from the strict methodology of quantitative academic research, relating, thus, to the notion of pedagogical research proposed by Lankshear & Knobel (2008): non-positivist, including teachers as active participants and establishing research objectives aiming pedagogical improvement. In this regard, considering the strictly technical and non-dialogical instruction materials previously available on school garden implementation, the objectives of this research unfolded in opposition to positivism in scientific research, confined to scientific community (HAYASHI et al, 2011). Therefore, “(...) a research program for ethnosciences which might ground, guide and support the making of a new environmental rationale from local knowledge” (LEFF, 2002, p. 50, free translation) was pursued.
2 METHODOLOGY

Aiming to promote the knowledge built within schools, this research is characterized mainly as exploratory (GIL, 2007). All collected data and tools used, including the ones not mentioned in this paper, are available at the group’s website (grupohortasbiousp.wixsite.comHORTAS).

2.1 SAMPLE

This research was conducted in the megalopole of São Paulo, Brazil. The administration of public municipal education in the city is divided between different districts, which have their own Regional Board of Education (RBE). Each RBE is responsible for, among other things, “manage a) the teaching and learning process in compliance with education policies, guidelines and goals; b) administrative, financial and human resources activities, which are relevant to them” (SAO PAULO, 2019, art. 72, item I). Based on a prior diagnosis (SECKLER; FLORIDO; ATAÍDE, 2016), we selected the Municipal Schools that already possessed school gardens within Butantã district RBE, resulting in five Municipal Elementary and Middle Schools (MEMS) and ten Municipal Preschools (MPS) (Table 1). With this design, the considered standardization was established at the administrative level, possibly elucidating common actions at participant schools. It must be highlighted, however, that the generalizations of inferences made in this study should be taken cautiously, in regard to each school’s particularities at implementation, usage and maintenance processes.

Table 1: Participant schools, their educational stages (MEMS and MPS) and the type of data (quantitative and qualitative) collected. This list was established based on the school garden diagnosis performed by Seckler, Ataíde e Florido (2016).

| School                                      | Questionnaire | Interview |
|---------------------------------------------|---------------|-----------|
| MEMS                                        |               |           |
| Vianna Moog                                 | x             | x         |
| Anexa ao Educandário Dom Duarte             | x             |           |
| Tarsila do Amaral                           | x             | x         |
| Profa. Ileusa Caetano da Silva              | x             | x         |
| Teófilo Benedito Ottoni                     | x             | x         |
2.2 DATA CORPUS

Methodological design comprised quantitative and qualitative approaches. At a quantitative perspective, the study developed and adopted a closed questionnaire, responded by 88 teachers, 15 pedagogical coordinators, 52 employees (outsourced and administrative) and 47 students (only students from MEMS participated in the research), and qualitative data came from 11 semi-structured interviews. The interview participants were set based on the questionnaires’ results on the “who is the main collaborator to the school garden?” question in the quantitative instrument, determining, thus, one interview per school with the individual most frequently named. The goal was to adopt, through the interviews, a methodology which encompasses individual perceptions of those who are most actively engaged with school garden spaces.

Quantitative data collection took place between March 2016 and June 2017, while qualitative data were collected from August 2017 to June 2018. The analyses scope is restricted to the perspectives of pedagogical coordinators, employees, teachers and students who were engaged in the selected schools. It is, thus, pointed out that the sampling may not allow the observation of all possible initial challenges, given that only schools which had successfully achieved school gardens at the time were included.
2.3 INSTRUMENTS

The adopted questionnaire had mixed type questions, containing i) trichotomic answers (“yes”, “no” and “I don’t know”), ii) multiple choice answers and iii) multiple choice answers with an “others:” option, allowing participants to write a different option, when necessary. Those questions were structured in three axis, ‘implementation’, ‘maintenance’ and ‘usage’, and were adapted to each participant category (Table 2). The main purpose of the different distributions verified at Table 2 was to optimize the time each participant took to complete the questionnaire, containing up to 38 questions to teachers and employees.

Table 2: Questionnaires' structure, according to the sections answered by each participant’s category.

| Participant’s category | Axes answered                                      |
|------------------------|----------------------------------------------------|
| Students               | Implementation + Usage                             |
| Pedagogical coordinators | Implementation + Maintenance                     |
| Employees              | Implementation + Usage + Maintenance               |
| Teachers               | Implementation + Usage + Maintenance               |

The adopted qualitative instrument was a semi-structured interview, with 11 pre-established questions that could be answered freely. The data set corpus were obtained from notes taken while participants orally answered the interviewer’s questions (BELL, 2008). According to the respondents answers, new questions could be proposed, leading to a wider access of each participants’ perception.

2.4 LIMITATIONS

On the possible limitations of quantitative instrument, and considering that the adopted questionnaires were developed for this study, there are some elements that might impose restrictions in the questionnaires’ internal reliability and validity, which were not assessed in this research. Thus, the questions’ formulation, such as possible ambiguities, suppositions, imprecisions, inductive questions and researchers’ and participants’ prior knowledge when interpreting the questions might have lead to non-answers (treated as invalid) or a low number of answers to a specific question (BELL, 2008; LANKSHEAR & KNOBEL, 2008). Therefore, the need to take into account the limitations of the inferences and generalizations made from the data gathered exclusively through this quantitative instrument is once more highlighted.
Yet, this kind of instrument is frequently mentioned in academic literature on education research by many authors (e.g., OLSSON & GERICKE, 2016; SHI et al., 2016; BULLA et al., 2017), who expose some convenient aspects, such as the easy handling in face of sample diversity, aiming for systematic research, given large scale samples and direct analysis of results through descriptive or inferential statistics, with no need for encoding numeric data (LANKSHEAR & KNOBEL, 2008). As a way of coping with the related methodological restraints of quantitative approach, and as a complementary data corpus, semi-structured interviews were conducted (BELL, 2008).

Besides the limitations related to the instruments, we also point out the limited sample size, especially in regards to the qualitative data (only 11 agents were interviewed), given this study’s financial limitations and schools’ internal organization and personal availability issues.

2.5 ANALYSES

Analyses and discussions were established based on six thematic axes, constituting thematic categories (MINAYO, 2004 apud FERRETE & SOUZA, 2018) defined a posteriori: “financial resources”, “human resources and school staff integration”, “external relations”, “environmental restraints”, “initial and continuing education” and “didactic potential perception”. For each axis, the pertinent questions were analysed, from questionnaires and interviews, to evaluate each of the six factors separately across the steps of implementation, maintenance and usage. Answers to questionnaires and interviews were triangulated with the goal of pointing out the connections between the axes, aiming to diagnose the most relevant elements perceived by the participants. The main findings for each axis at the three steps are described in the “results and discussion” section.

The questionnaires’ analyses were also made considering each school’s participant categories, with the objective of identifying common perspectives of students, pedagogical coordinators, employees and teachers. Within each category, analyses were made considering groups of only MPS, only MEMS and all participant schools. The results were interpreted from each option’s absolute frequencies plotted in bar charts.

In this sense, the results are here presented in order to highlight the main findings concerning the proposed axes in each of the three steps. Every percentage cited represents the number of marks to each option relative to the number of respondents (for each category in
each schooling scope). It is important to notice that, when considering both MPS and MEMS schools, the first are more numerously represented than the latter.

Looking to fit the proposed thematic categories, the qualitative analysis took into account the frequencies of pertinent comments related to them. To questions 8 and 9, different categories were created *a posteriori*, aiming to specify each kind of difficulties reported in the interviews.

3 RESULTS AND DISCUSSION

The results are described within the three adopted axes: implementation, maintenance and usage. Excerpts from the interviews are exposed in italics and in quotes (ex: “answer to the interview”), but interviewed are not identified in order to preserve their privacy. The items from the questionnaires that are relevant for the discussion are presented in italics (ex: item), and the frequency in which they are selected appears in parentheses, also when considered important.

3.1 IMPLEMENTATION

Concerning the implementation step, one of the main challenges reported was the availability of human resources, pointed out in five of the interviews, in answers about the first difficulties found when implementing the project, for example:

“The main challenge was to find people with interest and time to help in manual work. The teacher did not have any partners in the school to share the work with.”

“Maintenance and usage always demand technical knowledge and human resources. External maintenance services would be a great help, although facing harsh bureaucracy for hiring these kinds of services. (...) Despite the schools’ initiatives at inviting parents to take part in the project (...), their help is important, but not essential, since it is a new resource with restricted availability and strong variation each year.”

“Organizing the parents (finding volunteers, scheduling workdays).”

“Lack of people to work in the school garden.”

In a question about the first people mobilized to implement the garden, all interviewees pointed out the participation of teachers and a third of them also indicated the participation of
students, coordinators and employees. A few external agents, like students’ parents, and the NGO Árvores Vivas were mentioned in three interviews from MPS.

Indeed, in the questionnaires, when asked about orientations and instructions received throughout the implementation, MPS coordinators highlighted *projects and partnerships with the school, experienced people’s support and collective construction with school community* with higher frequency, in 25% of the answers, and, on the *others* option, the NGO Morada da Floresta was pointed out once. For MEMS coordinators, among the most indicated items, only one (*projects and partnerships with the school*, with a frequency of 40%) referred to human resources.

Regarding the previous interview question about the first challenges in implementation, four out of ten answers mentioned difficulties concerning financial resources – a close proportion to the demand for human resources in this step. The answers pointed out difficulties such as lack of tools and means of transporting plants, absence of resources to purchase soil and high costs of building flowerbeds, given the scarce school budget.

In the questionnaires, concerning the first challenges in implementation, teachers and employees of both schooling scopes and MEMS coordinators indicated *absence or difficulties in obtaining funds* as a great challenge, however, a *lack of materials* was not a consensus among them. In addition, answers as *lack of teachers’ articulation* from coordinators, *lack of human resources* and *lack of orientation or support* from teachers and the high frequency of *I don’t know* from employees suggest a heterogeneity of perceptions among the staff. It is important to remark this diversity because it inhibits any affirmation concerning a prevalence of one specific demand over the others, instead, it draws attention to the fact that there is a variety of challenges being perceived differently according to different participants.

Regardless of this perception diversity among school agents, the teachers, who were indicated in the questionnaires as the main actors mobilized in implementation, perceived the *lack of human resources* (31%) as the main challenge in implementation.

In sight of the demand for financial resources, there was a question in the questionnaire related to how the tools utilized in the school gardens’ implementation were obtained. From MPS teachers and coordinators, the most common answers were *governmental resources* and *teachers*. Among MEMS coordinators, the most indicated answers were *teachers* (60%), *students’ parents* (40%) and *local community* (40%). MEMS teachers more frequently selected *teachers* (48%), *I don’t know* (34%) and *students* (31%). Among MEMS students, the most indicated answers were *teachers* (73%), *students* (26%) and *coordinators* (21%). These
data strongly indicate an association between the construction of the school garden and schools’ staff personal donations, especially teachers. This highlights the absence of financial resources for implementation of school gardens in the participant schools.

3.2 MAINTENANCE

In the maintenance step, the data revealed environmental difficulties that were absent in the implementation step. The main environmental challenge pointed by teachers (58%), employees (17%) and coordinators (57%) from MEMSs was the soil, qualified as scarce or inadequate. Those results were also verified at MPSs, by teachers (30%) and employees (21%), but, differently, the only answer among coordinators at this scope relates to “absence of solar light” – the second most indicated alternative for teachers at MEMSs (30%) and MPSs (17%).

Confronting the results about maintenance and implementation suggests a scenario in which the main criterion for choosing school gardens’ location was space availability. Even in the schools that reported different reasons to define the space where the garden would be implemented, the conditions associated with the place of choice resulted in further environmental limitations, given that soil quality rose as the main environmental challenge in maintenance, in spite of the criteria adopted for installing the garden (Figure 1). Those results indicate that most of the schools might not have many choices of places to start a garden, indicating that they might be forced to choose the only place with uncovered soil, regardless of its quality for cultivation. Therefore, not only accessible soil quality assessment and recovery techniques are demanded, but the school workers are faced with the need to adopt alternative strategies, such as jars or mobile and elevated gardens, or even to turn to other spaces, such as squares, parks and unused properties in the school’s surroundings.
In the interviews, difficulties related to financial resources became evident in the answers to the question about the main challenges in garden maintenance and usage. This type of challenge, pointed out in three of the interviews, hinders the start of the project: one participant reported that the slowness in getting funding for the school forced the director and coordinator to use personal resources to buy and transport plants and materials. Moreover, soil contamination analyses are fundamental for choosing a safe ground where to implement the garden, but one of the interviewees claimed that they tend to be expensive.

Coordinators and employees pointed out that the school provides the resources and tools used in maintenance (all MEMS coordinators and 85% of MPS coordinators, respectively, and 94% and 71% of the employees at MEMSs and MPSs, respectively). The higher absolute values in elementary and middle schools in relation to preschools for this question might be related to the fact that, in MPSs, a higher diversity of sources was verified for those resources: preschool coordinators marked options such as institutional public resources and students’ families, while employees from the same scope specified, on the others option, sources like personal resources, donations or ‘school purchase, I don’t know, teacher, compost given by a nearby company and director. Even with frequent contributions from teachers, MPSs might have a higher diversity of sources for obtaining tools used in...
maintenance, through institutional resources or student’s families. Yet, the schools prevail as
the main providers of these resources.

Besides financial resources limitation, the availability of human resources was also
reported among the main difficulties in maintenance, being mentioned in five of the
interviews. It was mentioned that there are periods within a school year, like long holidays or
recess, when personnel availability is even more scarce, though still fundamental. A limited
number of teachers actively committed to the gardens was also reported as a challenge. In one
case, it was stated that, because of the reduction in the number of teachers and employees
working there, the project had been recently discontinued.

One solution to this issue, beyond the obvious need for more school personnel, would
be strengthening the bonds between schools and the surrounding communities. This possibility
is still far from the schools’ current reality, reflecting on the answers from coordinators,
teachers and employees, who reported no participation of the local community in the school
garden. Coordinators were the ones who perceived the presence of surrounding community
members the most: 28% in MEMSs and 20% in MPSs. The main external agents participating
in maintenance are students’ parents, according to teachers (31% in MEMSs and 6% in MPSs)
and MPSs’ employees (24%). Surrounding community was indicated by an irrelevant
percentage of those school's staff categories.

In addition, the schools’ own internal community could still be more actively engaged
with the gardens, as part of a transversal sustainability project. When students, teachers and
employees were asked in the questionnaires if they had an interest in participating more in
school garden activities, the affirmative answers were marked by 84%, 58% and 61% of them
in MEMSs, respectively, while in MPSs, by 79% of the teachers and 44% of the employees.
Even though the alternatives did not include space for written considerations, many teachers
made relevant notes, such as with a helping staff member twice, lack of help and with
supporting people working with the teacher and 35 students in MPSs. Significantly different
from the only note made by a MEMS teacher, who wrote sufficient participation.

The employees’ reported participation in school gardens in elementary and middle
schools and preschools was generally in maintenance (54%) and in harvesting vegetables for
school meals (52%). Both in MPSs and MEMSs, employees’ answers reflect a similar pattern,
though with slightly different proportions between the options. Remarkably, the results
showed a low frequency of the no participation alternative in both elementary and middle
schools (10%) and preschools (12%), which suggests that the school staff are an important
human resource for school gardens. Yet, it must be highlighted that MEMSs employees perceived that they had more participation in the gardens’ planning (26%) when compared to MPSs (16%). Some of them were kitchen, garden staff or assistant teachers. It is possible that the practical essence of their positions might be related to the low reported participation in planning garden activities, restricting employees’ involvement to technical aspects. It is notable, though, that employees in MEMSs have perceived more participation in planning than in MPSs, where, as observed, the school garden’s responsibilities seem to be more distributed among school staff.

Regarding technical challenges in maintenance, teachers in both MPSs (33%) and MEMSs (14%) point to the lack of knowledge as the main technical difficulty. Coordinators showed similar perceptions. Differently, for employees, it seemed to have been less relevant, since only 13% of MPSs and 6% of MEMSs’ answers by this category reported it.

By comparing teachers’ answers to the question about the technical difficulties in maintenance to their answers to “Did you have any instruction/orientation for planning/implementing the garden? Of which kind?” (Figure 2), the majority of answers pointed to the absence of support among the teachers who perceived difficulties in maintenance caused by lack of technical knowledge. The low amount of valid answers received in these two questions would be insufficient to indicate the most reliable source of knowledge, however, among those who claimed to have had support from qualified personnel, there was a reduction in perceived technical difficulties from 73% to 58%, and other types of support might lead to even less technical difficulties in this step. School teams’ prior knowledge was shown to be important in this step, although, to those who do not possess them, further education at the Regional Board of Education, qualified people’s support, technical courses and school partnerships were important actions in overcoming this lack of knowledge. This result contrasts with the same comparison when considering the challenges for the didactical use instead, in which the kind of knowledge source (like continuing education or qualified personnel support or orientation) seems to have low influence on the proportion of difficulties reported. Thus, the types of knowledge sources might have had a more technical character, possibly more focused on the technical challenges of garden maintenance than on the instruction for didactic usage by teachers.
3.3 DIDACTIC USAGE

In this section, the results exposed are related to the challenges and perspectives on didactic usage of the school garden. Teachers point out as the main difficulties in this step the absence of initial (27% at MPSs and 13% at MEMSs) and continuing (26% at MPSs and 18% at MEMSs) training for utilizing this space as a didactic tool and the lack of human resources (56% at MPSs and 19% at MEMSs), differently from the demand for financial resources, more evident in the implementation and maintenance steps. Remarkably, when asked about the main challenges for didactic usage of the garden, MEMSs teachers marked *I don't know* in higher frequencies than MPSs teachers. This difference may relate to a lower involvement with the school gardens by teachers in elementary and middle schools than in preschools.

In view of the absence of human resources and the conditions for participating in continuing education on environmental issues, some of the results have a direct impact on
pedagogical actions, through teachers’ organization and its consequences for transdisciplinary pedagogical action. In the questionnaires, 83% of MPS teachers claimed to use the garden in their pedagogical activities, in contrast to 36% of MEMS teachers. None of the MEMSs had as many teachers using the garden as was observed in the MPS.

In this sense, Figure 3 discriminates the main difficulties faced by teachers who claimed not to use the school garden, even in schools where it was active. The most relevant reported challenge was the initial and continuing teacher training (50%), which did not contemplate the pedagogical usage of school gardens, and the second most reported difficulty was the lack of time for planning the activities (40%). In lower frequencies, other problematics were exemplified, such as the lack of didactic materials (20%), the absence of human resources (10%) and institutional support (10%). These results strengthens the hypothesis that the available types of initial and continuing teacher education seem to favor technical issues related to the garden in detriment to discussions which support it’s didactical usage. The reported challenge for time availability configures a deeper challenge regarding schools’ organization, highlighting teacher’s claims for adequate working conditions, concerning feasible time for planning indoor and outdoor educational activities, as well as personal availability.

![Figure 3](image)

Figure 3 – Challenges for didactical usage of the school garden reported by teachers at schools where the garden was active. *For the active or inactive garden’s status, instead of individual answers, the standardized answers per school, which are the answers signed by half or more participants in one school (excluded the I don’t know answers), were considered.
Figure 4 - Proportion of teachers who have reported challenges in maintenance of the school garden caused by the lack of technical knowledge, accordingly to the type of continuing education or received support in implementation.

Focusing on the schools’ organization for the development of pedagogical activities at the garden, perspectives on interdisciplinarity and transdisciplinarity approaches could be elucidated. In the questionnaires, more than half of the MPSs’ teachers reported that there were ongoing interdisciplinary projects in the garden (65%), while only about one fifth (22%) of the MEMSs’ teachers recognize the existence of this kind of projects. There is also an important increase in the frequency of I don’t know answers in the latter (65%) compared to the first (14%). Since preschool teachers are general educators, meaning they are responsible for many disciplines, the interdisciplinary practice is applied in different conditions in each scope, which has certainly influenced these results.

As a whole, considering the participant schools, the diversity of disciplines whose teachers do use the garden for their pedagogical activities exemplifies the potential for educational activities through transdisciplinary approaches, since the contents that might be themes for educational action are not restricted to the Science discipline. Among those cited,
Mathematics, English, Portuguese and Arts are a few of the subjects whose teachers could be more engaged in working on the school garden. Despite this potential, in most schools the answers for the number of teachers using the garden for didactic purposes were not so diverse, concentrating in few disciplines (Table 3), indicating that, regardless of the interdisciplinary approach for environmental themes oriented by official documents (like the city curriculum), it is not fully applied in the schools.

Table 3: Number of disciplines whose teachers do use the garden, per school, according to respondent MEMSs’ teachers. *These reported numbers have not taken into account the number of indications of the alternative preschools, since they do not comprehend the analysed scope.

| School Unit | Number of disciplines whose teachers reported to use the garden |
|-------------|-------------------------------------------------------------|
| MES1        | 4*                                                          |
| MES2        | 2*                                                          |
| MES3        | 2                                                           |
| MES4        | 6*                                                          |
| MES5        | 1*                                                          |

Still in relation to questionnaires, MEMSs teachers were asked which disciplines’ teachers used the garden, and the answers with the highest frequencies were Science (39%), Mathematics (24%) and Physical Education and teachers don’t use the garden, both by 21%. There was also one indication of the use by History and Geography and Art teachers, marked less frequently than Portuguese (12%). Among the answers written in the others alternative, Informatics, fundamental 1 (elementary and middle school), afterschool classes and a few from fundamental 2 (middle school), English and Only in the moments for the project, as far as I know were mentioned.

Indeed, Figure 4 shows the existence of interdisciplinary work in the school garden in each schooling scope and by each of the MEMS disciplines. It is remarkable that in 80% of the MEMSs, at least one teacher responded affirmatively to the existence of interdisciplinary projects. This supports the hypothesis of absence of shared involvement with the school garden, at least in terms of the existence of ongoing interdisciplinary projects in that space. Figure 4 also points out the disciplines which the teachers were perceived as the most committed to the alleged interdisciplinary projects: Sciences, Mathematics, Physical Education, Portuguese and English. Once again, the MPS’s disciplines organization was
reflected in the results, with a perception of a closer involvement with an interdisciplinary approach, since the existence of interdisciplinary projects was marked in 65% of the answers.

![Figure 4](image)

**Figure 4** – Proportion of mentions to different disciplines which the teacher uses the school garden didactically, among teachers who have reported the existence of interdisciplinary projects.

Figure 5 allows a first attempt at understanding how the challenges in didactical usage might be related to the perception of absence of ongoing interdisciplinary projects in the school garden. In spite of the reduced number of valid answers, once again the perception of lack of support from human resources (73%) and the absence of initial and continuing training (64%) are pointed out as challenges for the interdisciplinary work. These answers’ frequencies among the teachers who have reported the absence of this kind of work, are quite higher than the other perceived challenges (lack of institutional support, time for planning and pedagogical materials).
### Difficulties for didactical usage cited by teachers who claimed that interdisciplinary works did not exist on the garden

| Difficulties for didactical usage | Proportion of teachers who reported each difficulty |
|----------------------------------|---------------------------------------------------|
| Lack of time for planning        | 27% (3/11)                                        |
| Lack of institutional support    | 36% (4/11)                                        |
| Lack of specific initial training| 64% (7/11)                                        |
| Lack of specific continuing training | 64% (7/11)                                     |
| Lack of assisting personnel      | 73% (8/11)                                        |
| Lack of didactical material      | 9% (1/11)                                         |

Figure 5 – Proportions of teachers who have indicated different types of challenges for didactical usage of the school garden, considering only the ones who reported that there wasn’t any interdisciplinary work in that space.

Dealing with the perception of challenges while planning school garden activities, the proportion of reports on the existence of collective discussions about planning the school garden’s activities in face of the perception of lack of time for it was assessed (Figure 6). The graph shows that having collective discussions might not have a significant impact among the teachers who reported to have perceived this absence of time as a limiting condition. This suggests that time for planning is a limiting factor regardless of the possibilities of sharing this responsibility with others, also indicating that the existence of collective discussions about this theme does not imply in additional work for the ones who are committed with the school garden.
From a different perspective, it’s also important to highlight the teachers’ perceptions concerning the pedagogical gains associated with the involvement in school garden activities. Nearly all participant teachers have reported to believe that there are pedagogical gains in engaging students with the school garden (96%). Among such gains, there is a perceived widening of didactical possibilities (88%) and approaches to curriculum contents (85%), as well as perceived attitudinal gains (71%) and increased students’ commitment with school activities (71%). Considering all the teachers’ responses for those questions, it is important to remark that these frequencies overcome the frequency of teachers who actually use the school garden (62%). This might suggest that the gains associated with the engagement in activities on the garden – or, at least, the perception of those gains – is shared among teachers in spite of the posed constraints, and the classes and disciplines which use that space.

Thus, from the teachers’ answers in the questionnaires, a near consensus was verified about positive changes that happened after the school garden’s implementation, such as a higher sociability among students, which facilitates integrative, participative and collective didactical approaches, beyond the traditional curriculum contents (Figure 7).
Figure 7 – Perception of positive attitudinal changes perceived by employees and teachers, according to the didactical objectives posed for the school garden. *For each pedagogical objective, instead of individual answers, the standardized answers per school, which are the options marked by half or more of the participants per school, excluded the I don’t know answers, were considered.

4 FINAL REMARKS

Even though each school has its own particularities, this research allowed the identification of some patterns in their processes of implementation, maintenance and usage of the school garden. Implementation was limited by space availability, which was the main criterion used to choose its location, disregarding other important factors, such as soil quality, luminosity and particularities of the desired crops. The main perceived difficulties in this step were relative to human, material and financial resources. The lack of workforce, for example, appeared frequently in the questionnaires of all participant groups. However, it is important to highlight that, in preschools, this difficulty appears to be less important than in elementary and middle schools, possibly due to the higher participation of the local community, mainly from students’ parents. On the other hand, the availability of financial resources and materials
appears to be strongly relying on school staff’s personal donations, since the public school budget is currently insufficient to meet the garden’s needs.

This condition poses a limiting challenge to the implementation and didactical usage of school gardens, since it generates additional workload and costs which are, in fact, government responsibility. In this way, Plaka and Skanavis (2016), claim that, in schools with no garden, the lack of financial resources is identified as the main difficulty in its implementation. We emphasize, then, the need for continuous institutional financing alternatives like partnerships with other social actors, provided that school budget autonomy is maintained.

Difficulties in maintenance are worrying, since they increase the probability of the school to abandon the garden project (BERNARDON et al, 2014). In this step, important environmental factors were identified. Choosing the place for implementation of the garden, which was not initially identified as an important barrier, became a difficulty in maintenance, when environmental factors appeared to be limiting crops’ growth. Among these environmental factors, soil quality was the most relevant, revealing the demand for soil analyses before garden implementation. If the schools’ soil is inadequate, alternative garden structures are suggested (eg., vertical gardens, suspended gardens), or, if possible, occupying places at the outskirts of schools, such as public squares. This also strengthens school capillarization in the territory, alining with Sao Paulo’s Strategic Guide Plan.

As in the results obtained by Bernardon et al (2014) on the maintenance of school gardens, difficulties related to human and financial resources in the participant schools were also identified. Remarkably, there is an unstable reliance on staff and teachers’ voluntary work and donations when responsibilities were not shared as part of an institutionalised school project. Addressing this issue, the possibility of more engagement of students and non-teacher employees in this step, through the integration of learning activities and maintenance demands, fosters new learning options and readjustments at work division. It is important to notice that the inclusion of the school garden as a project encompassing the whole school community enables a higher engagement from teachers and the sharing of responsibilities concerning the garden. Moreover, it is possible to foment the involvement of other social actors, especially students’ parents and local community, widening their relations with the school (as related by Machado and Brandão, 2017). This could reinforce the schools’ reach as public learning spaces within their territories. Nonetheless, it must be highlighted that there is a high demand
for specific continuing training focused on maintenance in order to overcome the difficulties in this step.

The absence of specific training seems to pose an even greater problem for pedagogical usage of the school garden by teachers. Even though the access to continuing education has been associated with a considerable decrease in maintenance difficulties, for the didactical usage, it has not had the same effect. In this step, prior knowledge was the most important resource when dealing with challenges. This may suggest that the received trainings have adopted an essentially technical perspective, possibly related to garden keeping. This highlights the need to promote continuing teacher education also focused on the development of pedagogical activities on school gardens. Additionally, it was observed that there is a low number of teachers per school working with those spaces, mainly at elementary and middle schools, associated with a shortage of interdisciplinary activities.

Counterpointing the reported lack of teachers’ involvement, there was a general perception of positive effects of garden use on students, both in behavioural and pedagogical aspects, as well as the potential for improving learning conditions at the school as a whole. These perceptions are in agreement with national and international studies, in which school gardens have shown to provide a collaborative and participative way of learning, besides positive behavioural changes (PEREIRA et al, 2012; PLAKA; SKANAVIS, 2016; SOUZA-FILHO, 2017). In this way, the school garden is revealed as a highly practical tool in the schools’ commitment to a broader and more sustainable social reproduction project, which can include debates on solid wastes, nutritional security, water use and equity in human relationships.

The potential of school gardens as a tool for breaking the school separation rationale is, thus, highlighted, for integrating intellectual and practical works and contributing to overall education of critical and active citizens. Therefore, the possibility of promoting school gardens as an institutional project, potentially amplifying school community engagement and integrating local community knowledge, is once more emphasized.

Overall, the main difficulties found originated both in the limiting of the project to few people and in the physical particularities of each school unit, with critical limitations on institutional support. It is imperative to better understand the reality of the average school, inserted in its territory and composed by qualified professionals who are normally overloaded, frequently working in more than one school simultaneously, responsible for a high number of students and both socially and financially neglected (PATTO, 1992; ALVES; PINTO, 2011).
All of the participating school garden experiences, both in preschools and elementary and middle schools, had some access to instruction or help from one or more external agents, especially via human or financial resources or access to training. It’s important to highlight that it is the duty of Municipal Department of Education to provide initiatives of initial and continuing teacher education on environmental issues and to promote articulation between school units and surrounding communities. Thereby, the government, in this case, City Hall, especially through the Departments of Education and Environment, among other public agents (e.g. Universities, Public Healthcare Units or other Departments) has a central role in supplying financial resources and instruction, both technical and didactic, to facilitate the maintenance of school gardens, as well as teachers' usage of the space.

In face of such results, the potential of school garden use as a learning tool for teaching improvement is reinforced, not only broadening possibilities of working on curricular contents, but also allowing educators to deal with problematics intrinsic to schools and their own territorioriality. The possibility to implement the school garden in the surroundings can also be enriching, by potentializing both the plurality of local knowledge and skills for civic and democratic participation or even allowing the capillarization of educational actions in the territory. In that way, it becomes a space capable of stimulating partnerships between the schools and other entities and allows the formation of networks, collective actions and mutual support relations between society and school units, constituting, therefore, a space capable of nurturing a new Environmental Rationale.

Considering such results, here are presented a few guidelines that might be strategic in fostering current and future school gardens in Sao Paulo.

5 EXECUTIVE SUMMARY

- Fostering and expanding teachers’ continuing education, focused in transdisciplinary didactical practices in school gardens, as proposed by Municipal Policy on Environmental Education (Municipal Law 15.967/2014).
- Fomenting teacher training on collective construction of school Pedagogical Project Policies, contemplating transdisciplinary action in view of sustainability.
- Facilitating teachers’ meetings, in order to increase the sharing of their own experiences and reflections about working on school gardens, approximating teachers who already develop such practices and those who do not.
Development and distribution of free access collections of didactical activities and associated educational materials that may be used or adapted by teachers to work with school gardens.

Stimulating partnerships between schools and educational research institutions, like universities, for the production of the materials mentioned above.

Hiring agronomy professionals to support implementation and maintenance of school gardens in each RBE, as proposed by Municipal Plan on Food and Nutritional Security (2016-2020).

Hiring more teachers, both in preschools and elementary and middle schools, in order to reduce the number of students per teacher in public school classrooms.

Improving work conditions for teachers so they may better use their time in school, by immediately increasing salaries and by providing more career stability (facilitating teacher participation in career enhancement events, implementation of transparent retirement policies and the creation of scholarships for teachers’ professional improvement at research institutions or grad schools on teaching).

Providing soil quality analyses to schools.

Flexibilizing budgetary guidelines on the use of financial resources already headed to schools, contemplating the complexity of school gardens’ demands in maintenance and didactical usage.

Building a broad diagnosis, lead by an interdisciplinary team organized by the City Hall, focused in the urbanistic project of the neighborhood where the school is placed, aiming to survey local social and environmental issues as well as the public apparatus (e.g. Basic Healthcare Units, Regional Council on Nutritional and Food Security, urban parks, residents associations) that might act as partners with schools engaging in collective actions for the local environment. This kind of articulation aims to strengthen local organizations that expose those perceived social and environmental issues.

Promoting joint actions between Education and Labour Departments, aiming to facilitate the students’ parents and the local community to have access to actions performed by schools during school hours.
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