

# How can a garden be used to learn Science? A students' point of view in a collaborative garden project

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## Abstract

The presence of natural life in a garden at school can be a chance to increase interest in Science. How a garden project can improve teachers' dedication to practical activities and students' interest and learning? These answers are rarely investigated and there is a risk to fall down in classes "hands-on" only. This paper aims to relate and analyze a garden construction to support children involvement with nature and Sciences, considering interdisciplinary and practical activities contribution at fundamental level in Brazil. Questionnaire applied to students indicates that project could collaborate to sustainability and to their preferences for Science subjects.

**Key words:** practical activities; Science teachers; collaborative project; natural life

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## Introduction

Schools can build a garden only for aesthetics appreciation, as a manner to refresh the school environment or even to fulfill the school space. Moreover, many children currently live in an apartment and the rural contact is decreasing, isolating human life from the rest of natural world. This way of life probably does not include significant experiences to base conceptions or give relevant information to students think about themes that can be discuss in Science classes.

For this article, the presupposition is that is a lack of information of how can a garden be used to learn Science and Science Education, researchers need to know the difficulties, benefits and kinds of educational approaches in a garden construction at schools. The experience of a school garden implementation (including greenery garden) seems to be common but the analysis of this process maybe provides comprehensive elements to enhance children learning and interest in Science. This work proposes to seek for new ways to fulfill school space turning the garden place to an *educational garden place*.

School can approximate children and natural life. The presence of natural life in a garden at school can be a good chance to learn Science and increase the students' interest in botany, soil science, zoology and many other matters present in the Science curriculum. Depending on the scope of approach, a garden can collaborates to discuss biodiversity, sustainability, agriculture and forms to improve the human relationship with nature, helping teachers target the purpose of Science education. The process of a garden construction by students in school can, even, collaborates to effort to maintain children in schools because develop a strong lies between students and their school face their contributions to local design, in an belonging process to be more understanding.

This paper also aims to relate and analyse a garden construction to support children involvement with Science, considering interdisciplinary relation about school subjects at fundamental level in Brazil. This project was supported by PIBID (Programa Institucional de Bolsa de Iniciação à Docência - CAPES - Brazil), designed to better prepare teachers in Teacher Training Courses given a scholarship to graduate students work directly at school with school teacher in collaboration with university. Graduation students are from Biological and Agrarian Sciences training course at ESALQ (Escola Superior de Agricultura) in USP (São Paulo University), Brazil.

## Practical activities and experimental classes at school

Practical activities rarely are investigated in Biological teaching. They are not frequent at schools. Cachapuz et al. (2005) consider that Science teaching is based on books, without real experimental works and, when it exists, experiments are planned like a list of recipe, minimizing comprehension and investigation, aspect characteristic of science activity and science researchers.

Recommendations of Science Education studies aims to give chances to student ask, built, create by themselves solutions and compares their own hypothesis with another's, facing the results of phenomenon (POZO; CRESPO, 2009). The construction of knowledge of someone needs action, according to Piaget view of cognitive development and this is a process that could be supported by the teachers according many investigations in Science education, because teachers can propose problems in an experimental form in a mastermind role to support students' learning (CAMPANÁRIO; MOYA, 1999).

In this work, the garden was conceptualized to be a field for exploring possibilities and guide experimental activities, specially organizing a school space for students experience with nature, exploring perception and human senses like touch, smell, taste, vision and hearing. So this article describes an experience to build with students and Science and Geography teachers a school garden called a "Garden of Senses", with different kinds of plants to give opportunity to perceive human senses, like plants used to taste (for an example, mint). The hearing was frequently the sound of cars but students are training to hear birds, wind blowing in the leaves (and, sometimes, cicadas), bringing good sensations to people is this space.

It is a challenge for teachers bringing practical activities to the Science class. In Brazil, São Paulo state, teachers understand the necessity for more practical activities, but feel anguish because they do not know how to make it happen, are insecure and have a lack of school structure and human support. According to teachers interviewed, the role of practical activity is to show theoretical concepts, ideas that implicate rarely used activities in Sciences Education (ANDRADE; MASSABNI, 2011). Practical activity in Science education refers to "student tasks to experiment directly the material physically present, with the phenomenon and/or dates retired of natural or social world" in authors conception (ANDRADE; MASSABNI, 2011, p. 840). The physical experience with object was explain to support empiric abstraction align to the Piaget theory, when someone uses experience to explore ways to extract information of object and the

analyses is a mental action to get conclusions about it.

Borges (2002) indicates that a science empiricist-inductivist approach is present when perception is a form to learn the scientific knowledge, understanding that it could be discovered using human senses without preconceptions or previous ideas. In the other hand, the constructive conception of knowledge understood that experience depends on mind and previous ideas to interpretation facts and phenomena. So, practical classes in a garden easily can fall down in empiricism view of knowledge or even in a practical focused action on didactic tasks (practical tasks without theorization).

This project was developed in one Brazilian school over three years and registered in reports, pictures and questionnaires, applied to understand students' point of view in the final of project at school. The objectives of this article are to:

- 1) Describe an experience to plan a garden of senses in a collaborative project;
- 2) Analyze the students' point of view of this construction about Science interest and learning at school.

### **Results and discussion: practical activities in the school garden**

The project participants were Geography teacher and a scholarship Science teacher and their students (11 – 14 years old at a public school – Second cycle of Fundamental level in Brazil). Five scholarships were designated to students in teacher training courses, who participated. They learned “how to teach” using practical activities in the garden place and also help its implementation. Two university professors coordinated this PIBID subproject at ESALQ, in São Paulo University, Brazil.

Project conception suggests university and school collaboration, different institutions with different objectives. The first accord for collaboration between school principal and professors of university was thinking together about garden aims and design and the teacher's role like a protagonist. The garden will be a school garden, so great effort was direct to orientation undergraduate students, teachers and the school principal to imagine collaboration in a form to support construction continuity during the week, without university presence. Weekly graduate students went to school for plan the garden and built the garden, given classes during this process.

The idea of a garden of senses construction came from Science teacher intention to bring practical activity in theme “the five human senses”, a matter present in curriculum. The first classes in this theme were in the school laboratory, with a “trail of the senses”. In this trail, school students were blindfolded in their eyes and they had the experience to smell, touch and taste plants, like mint. After, students participated in a discussion about people that have

blindness and the necessity to include all people in society.

After planning this “trail of senses”, the participants planed the design of the garden. An important aim was to improve students' interest in Science school content and school students' participation in implementation, with suggestions about plants and “putting their hands in soil”. The professor coordinated the project and school principal listened to a gardener to select the land to garden; graduate students asked about it in a gardening study group at university. There was a large place unused to garden implementation but there were divergence of ideas about exact location (shadow, sun and declivity) and the criteria of evaluation was a point to reflection: in teacher training, it is necessary to learn about elements involved in criteria for better choices to teach.

Besides, nobody knew to build a garden, learning about it during the project execution. For the garden construction, many classes were “freeway”, in no directive model to teach. Children went to local areas and cropped, separated seedling, prepared the soil, and did actions to maintain the garden. At these actions, they asked about everything, showing more interest about environment than in the classroom. For evidence, it was noted that a child with Down Syndrome wants to help in garden and look for a relationship with colleagues at this place, changing the prior attitude in classroom.

Before the garden excursion, there were planned classes to environmental analyses of the area, including its suitability. At this phase of project, participants dedicated meetings to choices discussing options of better plants species to garden, of vegetables that do not offer dangerous to child (like prickly plants), the relationship between these choices and the Science education concepts to learn and choices that offer a sustainability idea to organized the garden place. For example, a Science teacher chose a natural inhibitor to eliminate the weeds (in this case, she used pine leaves in land for walkway). All concerns were to align garden to a safe and interesting “green room” for children at school. To separate land walkway, art teacher's oriented students in painting the barriers to garden plants, made in PET bottle in different colors and the project reach more teacher at schools. School principal acquired a greenhouse plant and math teacher used the geometric form of this greenhouse to explain math to students.

New classes were developed about seeds germination and conditions at school laboratory, bringing investigations of plans necessity of water and soil to better understand the plants growing in a garden. Water influences was the most important topic in classes, and project discussed the rain influences in vegetable price at market, when one of

scholarship graduate student simulated a market to buy vegetables with students.

Students learned about needs for water especially because there was a long period of drought in São Paulo State, linked to lack of water to population. This problem was perceived and school principal accepted ideas to capture rainwater in a container. Also PIBID participants helped the school to take care of garden life offering water irrigation. They managed the collaboration of a study group in theme in ESALQ to installation irrigation. The irrigation with a timer allows rationalize the use of water because provides an alternative to offer water to garden everyday at the same time, including vacations and others opportunities that schools are closed. Supply the necessity of water is a great problem in projects with green areas at schools.

The movement around the garden was to increase sustainability, extending the original area to plants trees, vegetables to eat, variety of species used in the agriculture of large scale. There were five locations in the garden of senses: to vision, with many flowers; to smells with seasoning for foods; to taste gustation, focused in flavor of plants; to touch, to feel different leaves and one more local to medicinal plant. Separate the plants facing these characteristics was very difficult because many species are used, at the same time, to smell and taste, for example. The process of construction finished in 2014 and after this period the classes in garden continues nowadays, even with the end of project. This school was accept like a model to another's schools in city and inspires new projects, according to local educational system leaders.

Some points in Science Education research should be analyzed. The interdisciplinary is a possibility when many dynamic processes are occurring in the garden. Plant germination and growing needs includes notions of biology, chemistry, geology and in one way to discuss the interdisciplinary notion of knowledge in relations to everyday life. Some examples of students questions listened at the garden during construction indicates that practical activities collaborated to associate garden with Science reason: "Why did this plant do not growth? (It is lack of water, there is differences of water necessity between species.)"; "Look! What is this, an earthworm in soil?" (Yes, it is. Is seems to be a fertile soil. Do you know why?). "Is it easy to find this pineapple around the world?" (Well, we need to investigate, it is a tropical plant).

Participants prepared classes focused bring together Science perspective included the point of view of human choices concerned to natural lives. For example, it was not easy facing declivity presents in the area and the suggestion of construction the garden in "level curves" form, like some agriculture plantations. People can choices to do level curves to prevent erosion, taking care of environment.

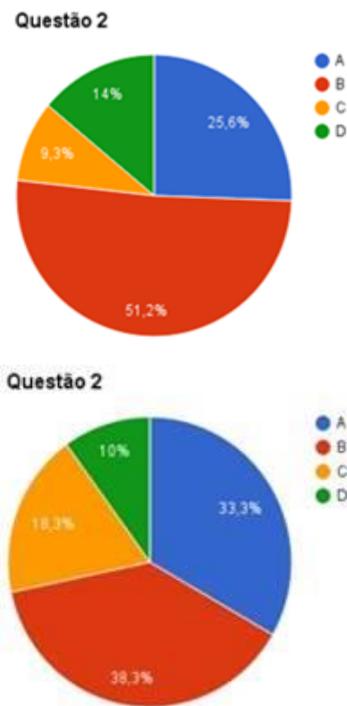
Teachers and PIBID graduates in teacher training courses planned how to take care of garden, with orientation of coordination to try connect classes in the garden with curriculum contends. Like says Cachapuz et al. (2005) Science teaching is based on books and in Brazil, S. Paulo state, teachers are required to fulfil the state workbooks and accomplish school curriculum proposed in state educational polices. The challenge for two teachers involved was to include the classes organized for garden construction in relation to matters listed in curriculum (plants are not required, according Science teacher) because the work in garden do not attend the curriculum sequences.

Graduate students from PIBID had the tendency to propose practical activities align to observation of the nature in botanic themes, like one class proposed to student observation only. After orientation from coordinator, this graduate student included the draw of garden species to explore with children the diversity observed in the garden. Others classes were planned by teachers and graduates teaching to plant, to clean the land, and other actions based on manual activities, only. The experience in this project was important to understand teachers and students in teacher training difficulties to plan classes based on practical activities focused in mental activities like comparison and phenomenon analyses like announce before (ANDRADE; MASSABNI, 2011) and investigates with hypothesis (POZO; CRESPO, 2009). It was possible to note that investigation was not the form of thinking about learning Science at school. Orientations from project coordinator to participants were relevant to change focus of classes but were not sufficient to support a different practice indicate in Science Education studies. The notions of teacher autonomy give opportunities to teachers decided and orientation could not obligate teachers to concept a class in different form. So, some classes were more "hands on" and this is a point to clear in this project. The problem was that practical activities can fall down in an empiricist view of knowledge or in "practicism" ("hands on", only) in didactic tasks. Skills can be the major gain, not learn concepts, for example, because build the garden was priority.

The work in garden showed the necessity to learn how teach skills to work in practical activities in relation to hoeing the ground, dig the soil to plant, prepare seeds to grow and another actions. According to Zabala (1998) exists a procedural knowledge and it was necessary in garden construction and teachers and graduate students need to learn how to orient children to act in the garden. Special care has been taken with gardening tools, because the uses of tool in security is essential; some child in project had difficulty to procedural action in the garden elaboration, probably due to few experiences outdoors. It was necessary to know if skills were the major gain in the garden project in opposition to the aims of enhanced children interest in Science and natural life. Next graphics indicated the student point

of view about school garden. There is information of two student groups (classes) that participated in garden project:

1) **How the garden contributes to your learn?**  
 Choices: A) Helps you to see in practice what is showed in classes; B) Collaborates to your preference for subjects like: agriculture, biology, foods, and plants; C) Contributes to bring more motivation to learn in classes' conducted in classroom; D) Help you to know how someone can made a garden; E) Do not contribute, for me.



**Figure 1:** Students' opinion from two classrooms in Brazilian school about the garden project contribution to learn (answers to Question number 2 on questionnaire). In the left, the graphic shows opinion of students from classroom A and, in the right, position of students of classroom B.

The analyses of answer to D) "Help you to know how someone can made a garden." indicated 14% and 10% of chose, a low percentage. The major percentage (51,2% and 38,3%) was B) "Collaborates to your preference for subjects like: agriculture, biology, foods, and plants". It suggest that the "hands on" importance present on alternative B) was not the most important to learn to student in the garden collaboration. The idea of enhance student interest in Science was noted, because almost a half of student chose the alternative B) in both groups. The alternative E) "Do not contribute, for me", was not selected in both group, suggesting the acceptance of project by students.

Another question to write explore the real contribution to children after participation on the garden project:

2) **How garden contributes to your school's view?** Answer in free form of write.

These concern answers in space preservation (more than 50%) and better understand nature (about 35%), besides mentioning the pleasure of have a different space to learn and to aesthetics appreciation (about 18%). Other answers were grouped in "outdoors classes are good"; "increase my contact with nature and crops" (many students live in apartments) and "changes of habitus and my way of thinking".

These answers about pleasure appoint the importance of garden like a different space in school to give idea of belonging specifically because school space is recognized like their space by the students. The idea of environment preservation with 50% of answers was a great surprise because the sustainably was secondary in project initially. Green area expansion at school, and consequences to city environment, is a good form to imagine how a garden be used to learn Science, for students: to improving environmental for population.

### Conclusion

The students valorize preservation and nature with the *educational garden place*. The "hands on" was seen as necessary to construct the garden place but it was not the most relevant aspect. The concern about practicism was oriented to look the form of procedural knowledge necessary to install the garden.

There were many classes in the garden during the construction by teachers and graduates participants of PIBID, and it shows the variety of Science themes that can be discuss with a garden. Also is a challenge prepare classes target to student participation and interdisciplinary, focusing in construction of knowledge, maybe because teachers and students in Teacher Training Courses needs to understand the classes in a way to support students construction of knowledge's science. In garden construction on collaborative project, another challenge is the maintenance the life in garden and participants need look for solutions together.

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