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Botany Teaching: An Overview of Academic Research in Brazil from 2002 to 2017

Camila Copetti[a]
Thaís Scotti do Canto-Dorow[b]

[a] Universidade Franciscana (UFN), Santa Maria, RS, Brasil, and Instituto Federal de Educação, Ciência e Tecnologia Farroupilha – Campus Santo Augusto, Santo Augusto, RS, Brasil.
[b] Universidade Franciscana (UFN), Programa de Pós-Graduação em Ensino de Ciências e Matemática, Santa Maria, RS, Brasil.

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ABSTRACT

The enchantment by Botany teaching represents not an ordinary feeling among students, and even Biology teachers, at every educational level. Researches throughout the Botany teaching area point to a fragmented, decontextualized, quite theoretical and unattractive process. Therefore, in recent years, Botany has changed from a beloved science into a neglected science because of the botanical blindness that has been established in the general population. Thus, the present work aims to present a panorama of the academic researches about Botany teaching in Brazil. It was carried out of theses, dissertations, and articles published from 2002 to 2017. This period was intentionally selected as it fits the establishment of the Guidelines Curriculum for Biological Sciences courses. In parallel, the pursuit of researches on Botany teaching in other countries was also carried out, to verify the international scenario. The investigations were developed in CAPES, IBICT, and SCIELO portals, based on previously defined descriptors. The results, published in Brazil and in other countries, point out the lack of information and a valorization crisis of the scientific knowledge in the process of Botany teaching, both in basic and higher education. This finding gains strength especially when we check the publications of the Biological Sciences – Licentiate courses. These should present deep concerns with the process of teaching to teach, as the teaching roots are similar to the way we receive and comprehend it, which seems the reason Botany teaching ends up being relegated when compared to other areas of knowledge.

Keywords: State of knowledge. Botany Teaching. Teacher training.

Ensino de Botânica: uma Visão Geral da Pesquisa Acadêmica no Brasil de 2002 to 2017

RESUMO

O encanto pelo ensino de Botânica não é um sentimento generalizado por alunos, e até mesmo por professores de Biologia, da educação básica e superior. As pesquisas sobre o ensino

Corresponding author: Camila Copetti. E-mail: camila.copetti@iffarroupilha.edu.br

na área da Botânica apontam para um processo fragmentado, descontextualizado, bastante teórico e pouco atrativo. Diante disso, a Botânica passou, nos últimos anos, de ciência amada para ciência negligenciada em razão da cegueira botânica que se instaurou na população de um modo geral. Assim, o presente trabalho tem como objetivo apresentar um panorama sobre as pesquisas acadêmicas, acerca do ensino de Botânica no Brasil, realizado a partir de teses, dissertações e artigos publicados de 2002 a 2017, período intencionalmente selecionado, que coincide com a vigência das Diretrizes Curriculares para os cursos de Ciências Biológicas. Em paralelo, foi realizada também uma busca de pesquisas sobre o ensino de Botânica em outros países, com o intuito de verificar o cenário internacional. As investigações foram realizadas nos portais CAPES, IBICT, SCIELO, com base em descritores previamente definidos. Os resultados publicados no Brasil e em âmbito internacional, sinalizam a carência de informações e a crise da valorização do conhecimento científico frente ao processo de ensinar Botânica tanto na educação básica como no ensino superior. Essa constatação ganha força, especialmente quando analisadas as publicações dos cursos de Ciências Biológicas – Licenciatura, que deveriam apresentar uma preocupação maior com o processo de ensinar a ensinar, uma vez que a forma de ensinar está enraizada na forma como a recebemos e aprendemos, razão pela qual o ensino de Botânica acaba sendo relegado, frente a outras áreas do conhecimento.

Palavras-chave: Estado do conhecimento. Ensino de Botânica. Formação de professores.

INTRODUCTION

When thinking about Botany teaching, it is fundamental to relate it to teacher training courses, especially the Biological Sciences – Licentiate course because, theoretically, it is the place and the most appropriate time to teach future teachers to teach Botany in elementary and high school. However, Salatino and Buckeridge (2016) state that, "today, most people who go through elementary and secondary education see Botany differently. "It is considered to be a dull and boring school subject, detached from the modern context" (p.177). According to these authors, historically, Botany has gone from a beloved science to neglected science at all school levels, including in teacher training courses.

The recognition of the importance of plants to man is so small that most of the time they go unnoticed or are seen as decorative objects or as a background for animals in general. Concerning this type of perception, Wandersee and Schussler (2001) claim that we have become botanic blind. Such a term is defined by Salatino and Buckeridge (2016) as "a) the inability to recognize the importance of plants in the biosphere and daily life; b) the difficulty in realize the exclusive ethical and biological aspects of the plants; c) the understanding that plants are beings inferior to animals, therefore, not deserving the equivalent attention " (p.178).

This botanical blindness is characterized by the difficulty to realize plants in daily life and to value their importance in the ordinary activities of people. Concerning this disinterest and general lack of attention, especially by the students of Biological Sciences – Licentiate, Kinoshita, Torres, Tamshiro, and Forni-Martins (2006) claim that the Botany, still today, is characterized as a much theoretical area, discouraging to the students and devalued in the teaching of Sciences and Biology. One of the reasons for this may be

insufficient Botany training in undergraduate courses, which creates a vicious circle, in which students who were not motivated for this area end up relegating its teaching to a lower level.

During elementary school, Botany is, in most cases, delayed to the end of the school year. Teaching it at schools is a concern but also a great challenge, as it requires adequate preparation by the teachers about their specific knowledge and the best didactic strategy to work the contents of that area.

In secondary education, a tendency to memorize scientific names, groups, dates and classification systems is observed, sometimes divergent in textbooks. Such an approach may discourage students and teachers, turning Botany in a mere section of Biology, increasingly neglected and less worked on. There is no concern, by the ones involved, to get to know Botany in a meaningful way, to engage students in the recognition of their environment and, from their school, neighborhood and/or their municipality, to study the plants and their relationship with people. Most of the times, high school classes are only theoretical, mostly linked to textbooks.

In higher education, especially in the Biological Sciences courses, we can also see a part of this vicious circle, in which the students – already disaffected and disinterested by the Botany they studied in high school – still struggle to resume studying this topic as something pleasant, important and fundamental for biological studies.

Although Brazil has a rich flora, diversified in each region of the country and quite exuberant, practical and field classes are neither consolidated nor attractive for teachers and students. Though schools are often home of a large number of Brazilian and regional flora, there are few reports of teachers taking advantage of this material to involve students, starting botanical knowledge out of this reality, understanding basic concepts and developing skills and interest in students. It is noticed that teachers do not feel comfortable to talk to their students about school plants, for example. As a result, Botany is not a part of students' daily life and studies, but simply memorized or "known by heart" by them, with no meaning.

The goal of this study was to investigate researches published on CAPES, IBICT and SCIELO websites, in the period from 2002 to 2017, in the area of formation of Biology Professors, in the teaching of Biology and Botany. In parallel, and in order to check the international scenario, research on the state of Botany teaching in other countries was performed.

METHODOLOGY

For André, Simões, Carvalho and Brzezinski (1999, p.308), researches that deal with the state of knowledge consist in reviews of studies and literature, which make a balance of knowledge based on analysis of different works and which deal with the same theme. The goal of these researches is to lead the researcher to discuss the production

found in this mapping and, with this, to answer his/her research question and to present aspects which deserve highlights to his intentional look.

Since questions about teacher education have increasingly dominated education and teaching studies, and this increasing number of research has reflected the concern felt and experienced by many researchers in this field, related to the quality of teachers' first education; and searching for a comparison with the researches involving the teaching of Botany that present themselves in an antagonistic way, since they still lack publications, we sought from the theme of Biology and Botany teaching programs to verify the existing and recently published academic production in the area of education and teaching involving Botany.

This search for theses, dissertations and articles was performed in three research portals named CAPES, IBICT and SCIELO, from 2002 to 2017. This period was intentionally selected as it coincides with the establishment of the National Curricular Guidelines for the formation courses of Biology teachers. Even in the works where the focus was not on initial teacher training, we sought to identify the contributions that these works brought to the teaching of Botany, the reason for this research.

The following descriptors were used in the three portals: initial training of Biology teachers, initial training in Biology teaching, initial training in Botany teaching, the teaching of Botany and didactic transposition in Botany teaching.

It is important to mention that when it was noticed that a specific work was available in the theses and dissertations database of CAPES and found again in the IBICT, only the first one was considered. Articles published and based on theses and dissertations already analyzed ended up considered to be as of interest for this research. Finally, if a single article was available in two portals, it counted only once for analysis.

RESULTS AND DISCUSSIONS

Botany Teaching in the National Scenario

The establishment of the National Curricular Guidelines for Biology teacher training courses was a remarkable moment to Biology undergraduate courses in Brazil after the period of transformation of Natural Sciences courses. However, the establishment of these guidelines was accompanied by another relevant factor that should be considered: the process of expansion of the Biological Sciences courses in Brazil, which, according to the INEP data, increased considerably after the institution of these Curricular Guidelines. This phenomenon is not isolated, as it is associated with the expansion of higher education courses as public policy in an attempt to raise the education level of the Brazilian population since the beginning of this century and is one of the targets to follow the world trend of raising population education.

In this scenario, we observe today a Biological Sciences – Licentiate course which has grown much more than undergraduate courses in general. However, there are a considerable number of idle places and a noticeable reduction in the number of graduates, year after year, according to data of the last higher education census. Thinking about of Biological Sciences – Licentiate course is thinking about the formation of teachers who understand the fundamentals of the sciences and who reveal a broaden knowledge vision, especially Botany, that must be seen as an inquiry and investigation object, in order to show the students the enchantment and passion of this rich and important area of Biology.

Many Botany classes, including the ones in undergraduate courses, are conducted in a way the learning process becomes mechanical, with isolated concepts, and meaningless to the student. This leads to monotony among teachers and disinterest among students. This way, Botany is studied by the books and not by the students' daily lives. Regarding this distancing from reality, it is stated that:

> The traditional approach guides the selection and distribution of content, generating memorization based activities, with rare contextualization possibilities. When carrying out activities which do not consider the immediate reality of students, the distance between the goals of the resource in question and the final product is perpetuated. Individuals are trained to repeat concepts, apply formulas and store terms, without, however, recognizing possibilities of associating them with their daily life. Knowledge is not constructed, and the student is relegated to a secondary position in the teaching-learning process. (Vasconcelos & Souto, 2003, p.94)

Table 1 shows a synthesis of the theses and dissertations found in each of the portals surveyed, according to the keywords used and the number of works that demonstrate how the researches on Botany teaching are.

Table 1
Theses and dissertations about Botany teaching found in CAPES e IBICT portals: 2002-2017.

Keyword	CAPES Portal		IBICT Portal	
	Total	Relevance to this research	Total	Relevance to this research
First training of Biology teachers	12	0	48	4
First training in teaching Biology	0	0	118	1
First training in teaching Botany	0	0	3	0
Training of Botany teachers	0	0	13	2
Botany teaching	30	4	38	1
Didactic transposition in Botany teaching	0	0	1	0

Due to their relevance and relation to this study, eight out of twelve papers are dissertations and four are theses; ten of them come from postgraduate programs in the areas of Science Teaching, Education for Science, Science, Science and Technological Education, and Biological Sciences. One of them is from a Masters Program in Technological Teaching and the other is from a postgraduate program in Agronomy, which are excellent aspects. Figure 1 shows the evolution of publications according to the keywords used in this mapping.

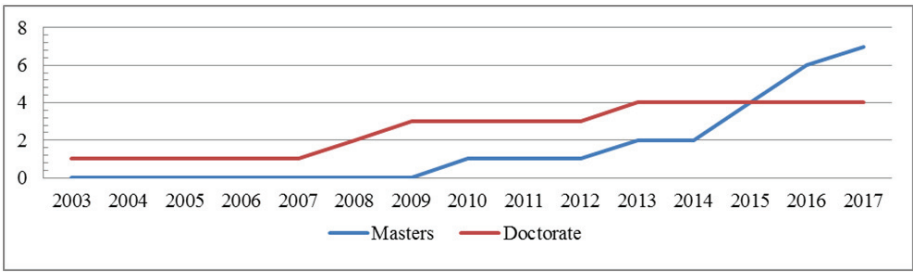

Figure 1. The progression of researches on the first formation of teachers in the Botany area in the years 2000.

The search for articles was carried out in two research portals using the same keywords: the CAPES journal portal and the SCIELO portal, according to Table 2. The same time criterion was used in this research: articles published in the area from the year 2002 on. Cases of articles based on theses and dissertations previously analyzed were considered as of interest for the research. It is important to emphasize that the research was carried out from 2002 onwards because of the establishment of the Curricular Guidelines for Biological Sciences courses.

Table 2
Botany teaching articles, found in CAPES and SCIELO portals' journals: 2002-2017.

Keywords	CAPES journal		SCIELO	
	Total	Relevance to this research	Total	Relevance to this research
First training of Biology teachers	8	1	15	1
First training in teaching Biology	23	1	10	0
First training in teaching Botany	0	0	0	0
Training of Botany teachers	2	0	1	0
Botany teaching	7	2	25	2
Didactic transposition in Botany teaching	0	0	0	0

Ninety-one articles were found using the keywords chosen for this study. Reading these articles, it was verified that only four of them had relation and could be meaningful

to this research, evidence of the lack of research in Botany teaching and teacher training in this study area.

It was possible to verify similarities among some theses, dissertations, and articles initially selected, so the works were divided into two axes. The first one is related to teacher training, considering the works about first training as well as those that approach the practices of teachers. The second axis was named as teaching and learning, considering the works in which a historical survey of the teaching of Botany in Brazil was carried out, as well as those works in which the researches led to the activities. Figure 2 illustrates this arrangement of the axes.

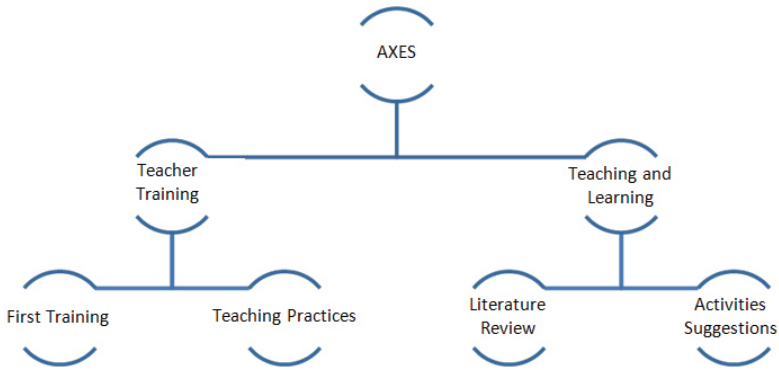

Figure 2. The arrangement of axes after the analysis of theses, dissertations, and articles.

Becoming a teacher is a continuous process which is imprinted by the knowledge acquired from the beginning of college education and which goes on throughout the teacher's life. Tardif (2002, p.18) claims that this is knowledge originated in different sources "that aim to achieve different goals at the same time, that are strongly made objective and subjective, difficult to disassociate from the people and their work situation", once theory and practice are interwoven in the different moments of formation and throughout the career of teachers..

The analysis of the works in this area reveals an increasing, despite a simple, number of publications with the topic related to the first training of teachers in the Botany area. Silva (2003), Gianotto (2008), Pucinelli (2010), Guimarães and Inforsato (2012) and Macedo (2017) carried out research involving undergraduate students in Biological Sciences in order to check the first training process, while Silva (2013) sought to know and describe the conceptions of teacher educators in college education. Most of the work uses qualitative research, in which semi-structured interviews were carried out to reach the goals.

In a smaller quantity, teachers' practices works were identified. Among these researches, we can highlight the ones by Amadeu (2015), Boas (2015), Liporini (2016) and Casasco (2017), all recent and focused on how Biology teachers work in classroom relating Botany content with memories, conceptions, and practices. Among these, it is

noteworthy that two papers proposed some differentiated wrap-up activity in non-formal teaching space.

The theoretical basis for the works organized in the teacher training axis is quite varied, as there is no unity among the authors who work on first teacher training or those who deal with teaching practices. The likes of Vygotsky, Morin, Freire, Leff, Tardif, Krasilchik, Cavassan, Garcia, among others, may be mentioned.

Out of the theses, dissertations, and articles which were analyzed, only two make a literature review regarding the teaching and learning axis. Güllich (2013), with his documentary research, made a survey from 1982 to 2001, in the annals of the Brazilian Botany Society, specifically in the Teaching section, while Giassi (2009) focused his research on papers presented at scientific meetings in the Biology teaching area. Both pieces of research have a qualitative character and have not used authors in common in their theoretical foundation. While Güllich (2013) relies on authors such as Vygotsky, Krasilchik, Gil-Pérez and Carvalho, Giassi (2009) supported his thesis in Freire, Moraes, and Morin in order to affirm that Biology teachers prioritize students' learning with content rather than using the context of the students' lives. With a somewhat different bias, Silva (2016) sought to find out what extent the textbook figures, which serve to help see, fulfill their role from a functional analysis defended by the authors whom he based his work on.

Yet in this perspective, the works by Faria, Jacobucci and Oliveira (2011), Stanski, Luz, Rodrigues and Nogueira (2016), and Nascimento (2017) were found. They bring proposals of activities for Botany teaching, though in unusual teaching environments, by the use of multimodal representation as a didactic strategy or even the construction of didactic and audiovisual materials for Botany teaching. In the three articles, botanic activities developed by teachers in elementary school are reported, and present theoretical foundations based on Garcia, Moreira, Zampero and Laburu, Guimarães and Vasconcellos, Kinoshita, Wandersee, and Schussler, among others.

Due to the low number of the theses, dissertations, and articles, even covering a long period of publishing (sixteen years), it was possible to check the lack of works in the area of first teacher training involving Botany. For this reason, papers related to elementary and secondary education which deal with Botany teaching were also selected. From the results presented in these works, it is possible to observe that the great concern of the researchers still sets on the specific content, the valorization of scientific knowledge, in their practices in the classroom, or even in unusual teaching spaces. Little is said about how to teach specific content, about being a Botany teacher and, especially, about the concerns with teaching to teach, which was not found in any paper from the portals.

Botany Teaching in the International Scenario

In order to obtain an overview of this theme at the international level, Botany teaching works published in Mexico, South Africa, India, the United States, and the

United Kingdom were selected. We consider them pertinent to this research and present them below.

Based on the article by Wandersse and Schussler (2002) previously mentioned, the authors of "The Pet Plant Project: Treating Plant Blindness by Making Plants Personal", Krosnick, Baker, and Moore (2018) recently published their work in "The American Biology Teacher"; it was developed with a group of students from Tennessee Tech University. The support to perform this research lays on the minute number of publications involving the Botany teaching in secondary school and college education in that country. With 209 participants, they attempted to show people the reasons why they should care about plants and how these affect their daily lives. More than recognizing plants as remarkably important; the greatest challenge has been to make botanical lessons interesting.

Through the "Pet Plant" project, the students cultivated an unknown plant from seeds, monitored its development by its growth, while receiving theoretical knowledge through classes and lectures. These activities happened during the same time and made students more likely to make connections with the knowledge and concepts they had experienced and acquired. After several semesters of project implementation, it was possible to conclude that the work positively impacted students' interaction with plants; increased their interest in Botany and their understanding of the subject. For most of the participants, this work was important to tune them in the details around. They described the activity as interesting and fascinating because, as responsible for the growth and development of the plant, they now have the ability to understand all processes.

Another study analyzed was the one by the teachers Melanie Link-Pérez and Elisabeth E. Schussler (2013), developed in the Department of Botany and Pathology of Plants at Oregon State University, entitled "Elementary Botany: how teachers in one school district teach about plants", and whose aim was to investigate how teachers teach about plants, as students rarely know as much about plants as about animals. Researchers suggest that students' interest in plants must be promoted from the earliest years.

It was found that, in general, textbooks used by the surveyed teachers and adopted by most teachers in the state of Oregon present plant and animal content differently, favoring and stimulating the understanding of animals compared to plants. Link-Pérez and Schussler (2013) state that there is a huge gap in the United States literature on how plant information is presented in elementary and secondary schools. Little is known about the science teachers' knowledge about plants, where they learned, how they feel about teaching Botany, what resources they use, what their practices are, and how they motivate their students to learn about plants. Even with the lack of research in this area, they say that scholars suggest that the lack of specific knowledge of Botany by teachers is affecting teaching on plants in formal education settings.

For the author, the results suggest that teachers are not adding instructions in addition to those available in the textbook and that efforts should be done in teacher training and curriculum development to help teachers teach Botany in the classroom, to give thought to the current form of teaching, to look for the natural environment for classes and thus to

begin to open the eyes of teachers and students to a more diverse, exciting and complex world of plants.

Another paper analyzed is entitled "Lessons for Teaching Botany: What Middle School Students Know about Plants" by Natarajan, Chunawala, Apte, and Ramadas (2002). It was developed in India with two different groups of students: one who belongs to a tribal community, and other who is part of the urban environment, in order to verify students' ideas related to plants and the role of experiments in school life by comparing informal knowledge with formal knowledge presented in schools by teachers through the use of the textbook.

So far, tribal students were seen as disadvantaged in formal education in terms of academic performance because their lifestyles and their knowledge about plants and forests throughout the generations remained unrecognized or underrated. Students from 10 to 15 years old from the schools selected to participate in this activity were divided in two large groups: one would work collecting a plant, and another observing and designing a plant, filling in a survey with information about the chosen vegetable, including their thoughts and feelings regarding the plant.

In documenting students' ideas, researchers willed to find an eventual connection between student knowledge, curriculum requirements, and what was studied by the textbook. The tribal students chose a lot more diverse trees than the urban ones, plants with social and religious significance or, in different terms, socially meaningful plants for their daily lives. And regarding what is studied by the textbook; more than half of the students brought or drew different vegetables compared to those presented by the books used during their formation. These results demonstrate the lack of textbooks in terms of Botany teaching and contextualization. The textbooks in India (and things are not quite different in Brazil) are poor in pictures, and the gaps in Botany teaching become visible when students draw the plants because they draw what they see and think about them.

Amélia L. Abrie (2016), author of "The botanical content in the South Africa curriculum: a barren desert or a thriving forest?" and a professor at the University of Pretoria, in South Africa, is concerned about the lack of researches regarding how Botany is neglected in the South African curriculum when compared to Zoology. In her study, she found that, although the curriculum addressed all the major botanical concepts, little time was invested in teaching that content. This negligence was clearly noticed in the initial phase, which is called a "foundation" in that country. Thus, the way content is presented in the curriculum may not be enough to provide the necessary knowledge about the plants and consequent awareness in that area.

Abrie (2016) uses other authors, such as Hershey, Honey, Uno, Wandersee and Schussler, Wilkins, who work on the theme, to claim that plants are the most important, least understood and most guaranteed of all living species. According to the author, there is a link between the neglect of plants in schools and the lack of interest of the general population for this group of living beings and, therefore, argues that the curriculum has been weakened in regard to Botany teaching.

Based on what the American Society of Plant Biologists says, a list of principles of Plant Biology for Science teaching has been developed on 12 levels, which essentially refer to contents for Science education. Based on this list, the contents and the study load for Botany were analyzed in the main books used for teaching in South Africa, all originally from the United States of America. It was clear that the number of hours designated to Botany teaching was lower than the number of hours for animal or human content at all evaluated stages. The amount of detail and depth in each topic varied in the books analyzed.

Besides the preponderance of animal versus vegetable content, some topics exclusively focused on plants, in addition to being less prominent in the South African curriculum, are recurrent. The author mentions the example of obligatory cultivation of plants such as beans, lentils or corn to determine the growth requirements, making the activity repetitive and unattractive. Curriculum analysis provided an overview of how Botany content is neglected in favor of animal content, especially on the basis, when children develop their understanding of the biological world and its interactions.

The author concludes that teachers shall understand the fact that simple activities, such as observing plants, learning their names, describing and comparing the different parts of the plant, may neutralize gaps in basic botanical knowledge and lead to the development of knowledge and skills which promote this pursuit on more advanced topics, which bonds the student and Botany.

In his work with ninth-grade students in Colombia, entitled "*La revegetalización como herramienta para la enseñanza de la Botánica en el grado noveno del Instituto Técnico Industrial de Tocancipá*", Arévalo (2011) reports how the recovery of green areas at the educational institution contributes to the learning of Botany, from the change of student attitudes.

The author mentions that in Colombia, a lack of environmental awareness and conservation, especially on endemic plants, is evident. He suggests that a change of mentality related to these aspects occurs due to the current curricular organization in the institutions, which do not have a specific subject for Botany teaching, and that the area of Natural Sciences centralizes teaching in general topics of Biology and, based on a North American author, encourages students to become interested in Botany through campaigns in schools focused on the symbol-tree or symbol-flower, enhancing patriotism which is typical in those countries. The author also proposes to work on afforestation with country's typical plants, a process in which the students are active participants from the planting to new seedlings. This is the only way students will be able to recognize the surrounding plants.

According to the activities, it was possible to check that the recovery and following conservation of the endemic plants were successful pedagogical practices for Botany teaching, enabling a change of vision and conception in the students. A Botany teaching carried out this way in the institutions allows students to recognize plants as living organisms and attribute them an intrinsic value, recognizing their importance and valuing their conservation.

The multidisciplinary work by Tirado, Santos e Tejero-Díez (2013), developed in Mexico, uses motivation as a strategy to teach Botany. These authors worked with a considerable number of students of the college education, assessing the mastery of knowledge acquired in high school and students' opinions about the teaching. In the evaluations, it was clear that there are many shortcomings in Botany teaching in high school throughout the country and that students classify as "good teacher one who arouses interest in what he teaches" (Tirado, Santos and Tejero-Díez, 2013, p.84).

After that, they worked with two groups of students. For the first group, they developed a series of activities aiming to stimulate, arouse interest and motivate students to learn Botany. And the results were according to the expectation: motivated students, as well as students convinced of their course, and the ones who had a family history of a higher level of education, obtained better results in the assessments.

It was clear that motivated and interested students, willing to learn the Botany content, end up learning more and better. In other terms, the quality and levels of learning that students achieve in a Botany topic are directly related to their motivation and involvement with the subject, which impacts the results of their learning. And this motivation leads to even better results when it happens at the beginning of the training course.

FINAL CONSIDERATIONS

According to the mapping carried out, out of academic productions about the first formation of teachers and their relationship with Botany teaching, it was possible to confirm the need for discussion and study on this theme, since the presented data, both national and international levels, indicate the lack of information about this issue and the crisis of valuing scientific knowledge in the process of Botany teaching.

As a result, it is clear that teachers should be well prepared to work, sensitize and modify this panorama, especially because the first formation influences the pedagogical practice later performed by the professional and, therefore, the most significant changes must occur during the first teacher training. The motivation, the enchantment and the willingness to learn, so they can later teach, must happen during the first formation.

Following this result about the lack of research and work involving Botany teaching, it is expected that, little by little, teachers and students overcome eventual difficulties concerning Botany teaching and learning, and that teachers find a way to encourage students to maintain contact with the plants around them, creating and adapting didactic activities in laboratories and in the surroundings of schools, houses, and public areas. In addition, it is expected that the taste for Botany will grow in this country with such rich vegetation and that people will learn to study, enjoy and spread Botany teaching so that plants can be seen the way they really are: not merely decorative systems but active components of nature.

AUTHORS CONTRIBUTIONS STATEMENTS

C.C. adapted the methodology for submission, collected and analyzed the data, performed the writing of the text and created the tables and figures. T.S.C.-D. mentored and supervised the research. Performed the final correction of the manuscript. C.C. and T.S.C.-D. conceived the presented idea, defined the descriptors, discussed the results and contributed to the final version of the manuscript.

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