Critical environmental education with family farmers in Brazil: The first steps of an action research against pesticide contamination

Educação ambiental crítica com agricultores familiares no Brasil: Os primeiros passos de uma pesquisa de ação contra a contaminação por pesticidas

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ABSTRACT
This study aims at the formation of knowledge about the fight against risk situations by the use of pesticides in plantations. It was held in a community of family farmers, located in the district of Joanapolis, in the state of Goias, Brazil. It consists of an action research developed by a center of research that seeks to favor the empowerment of the subjects in the face of risk situations. The study is carried out at farmers’ production sites and at the rural school where their children study, being carried out by the students of the Chemistry Major Degree at IFG – Anapolis Campus. By the use of qualitative instruments the main adverse situations in this context were identified and we report actions of the Center of Research. The critical perspective of environmental education is the theoretical
and methodological basis assumed for intervention. Considerations about the initial process of intervention are presented.

**Keywords:** pesticides, farmers, environmental education.

**RESUMO**
Esse estudo visa à formação de conhecimento sobre o combate a situações de risco pelo uso de pesticidas em plantações. Foi realizado em uma comunidade de agricultores familiares, localizada no distrito de Joanápolis, no estado de Goiás, Brasil. Consiste em uma pesquisa de ação desenvolvida por um centro de pesquisa que busca favorecer a capacitação dos sujeitos em face de situações de risco. O estudo é realizado nos locais de produção dos agricultores e na escola rural onde seus filhos estudam, sendo realizado pelos alunos do Mestrado em Química do IFG - Campus de Anápolis. Através da utilização de instrumentos qualitativos, foram identificadas as principais situações adversas neste contexto e são comunicadas ações do Centro de Investigação. A perspectiva crítica da educação ambiental é a base teórica e metodológica assumida para a intervenção. Considerações sobre o processo inicial de intervenção são apresentadas.

**Palavras-chave:** pesticidas, agricultores, educação ambiental.

**1 INTRODUCTION**
This article originates from the synergy of action research developed by the Center for Research and Studies in Teaching and Environmental Education (NUPEDEA), together with a small community of agricultural family farmers located in the district of Joanaolpis, Goias, Brazil. NUPEDEA is a relatively new center of research located at Federal Institute of Education, Science and Technology, Anapolis Campus. Registered in the Directory of Research Groups of the National Council for Scientific and Technological Development (CNPq) in 2014, it is composed by professors from different areas of knowledge and students from Chemistry and Social Sciences Majors. Study and research activities are developed by mutual collaboration between these subjects.

The work presented here corresponds to the first steps of an action research carried out by NUPEDEA with small farmers who are at risk from the use of pesticides. The research has been carried out by the undergraduate
Chemistry students and professors. The research site is the district where the family farmers work and at the rural school where their children study.

The socio-environmental dilemmas constitute a dimension of discussion and analysis of the Research Center. Thus, when we turn our attention to the surroundings of the city of Anapolis, we are faced with situations of risk to the life of the family producers, who have led us to intervene in the community. High rates of cancer in the locality DATASUS (computer department of the Brazilian Unified Health System), children and teenagers working in agriculture, inadequate handling and indiscriminate use of pesticides, use of prohibited poisons, lack of personal protective equipment (PPE) and little knowledge about the products used were found.

As the proposal of the Center intends to articulate teacher training engaged in social and environmental issues, we seek to know the social context of these farmers and intervene in situations of risk, with the development of actions, planned and executed by Chemistry students and professors involved in the research. We assume the critical perspective of environmental education in the empowerment of subjects. These theoretical assumptions, which will be outlined in the later on in this article, guide our reflections. However, it is important to highlight that this research effort is based on an empirical context, characterized by the interaction between farmers and students in the constitution of lower risk to life due to the use of pesticides.

Even if the study is still in progress, the research stage already allows for some inferences, especially regarding the socio-environmental context of the family producers. Then, we have chosen to present the article in three sections, in addition to this introduction: the first one presents the theoretical aspects that underlie action research; the second one elucidates, in an analytical perspective, the socio-environmental context of the farmers and student actions up to the present moment; and the third one presents some reflections in the form of conclusions.
2 CRITICAL ENVIRONMENTAL EDUCATION IN THE EMPOWERMENT OF SUBJECTS

In the field of environmental education, it is always appropriate to bear in mind that different conceptions prevail, ranging from the transmission of information about the natural environment to the dialectic of human relations. From this polysemy, the heterogeneity of intentions emerges, resulting in varied ideological perspectives (Sauvé, 2005A, 2005B; Carvalho, 2012; Loureiro, 2012). In general, environmental education discourses have a strong tendency towards approaches to natural components and pollution. As a result, a lot of emphasis is placed on the biological and physicochemical characteristics of environmental degradation, which are privileged to the detriment of its political, social and economic dimensions.

Designing environmental education exclusively for the reduction of degradation is the same as reducing it to a space management tool (Guimarães, 2004). The limitations and risks of misunderstandings become greater when views based on these assumptions disregard other important socio-environmental dimensions. Thus, the predominance of a depoliticized vision and the absence of critical positions become common in these perspectives, which contribute to the prevalence of hegemonic interests in social contexts.

In accordance to Leff (2010), concerns regarding natural aspects contribute to "ecologyze" the thinking of society, reducing the interpretation of social and environmental issues to the description of natural systems. In this regard, Foladori (2001) still points out that perspectives that are prioritized for this dimension promote the displacement of the vision on the socio-environmental problem, referring to simplistic understandings and inserted in a "natural" order.

This being so, we emphasize that the critical perspective of environmental education guides the view of this study. We assume that only information about the natural components of space is insufficient and that, faced with so many adverse issues of the present time, it is necessary to critically train people to deal with adverse situations that endanger human survival.
We believe that the critical view of environmental education may be part of a process that can provide subsidies for the challenges of contemporary life. We assume this and consider the human being inserted in the space of socio-environmental dimensions as well as life in its complexity and the understanding of environmental issues not restricted to the natural dimensions of space (Dias, 1994; Porto-Gonçalves, 2004; Jacobi, 2005; Reigota, 2009; Guimarães, 2007, 2011; Carvalho, 2012; Loureiro, 2012).

According to Oliveira (2016), the main purpose of critical environmental education lies in the formation of a person capable of identifying, questioning, proposing solutions and acting in the face of adverse social situations. Also, the development of these capacities is due to the very involvement of people in their social, political and economic contexts. Then, the critical perspective of environmental education through the formation of contextualized knowledge may provide a more complex and instrumented reading of the world for the intervention (Guimarães, 2004; 2007), being such knowledge constituted by the interaction with one another, and situated in the socio-environmental dimensions of the subjects' lives.

However, it is important to emphasize that knowledge alone does not guarantee changes in adverse social conditions. These are given by the very intervention of the people, in which collective action is fundamental, since it potentiates a greater involvement of the subjects and stimulates the formation of leaderships that dynamize the organized social group (Amann 1987, Guimarães, 2007; Lima, 2009).

The constitution of this knowledge among farmers, contextualized in the situations of risks experienced by the use of pesticides, corresponds to the main objective of the study. We start from the hypothesis that such knowledge is low, based on the reports of the practices of these producers by one of the Chemistry students who has lived in the community since his childhood.

Information as one of the main means in the construction of this knowledge, since it enables the subjects to judge the situations experienced. From it, people may have increased capacity to identify, analyze, exercise their
rights, claim service provision, and other citizenship exercises (Saito, 2000; Guimarães, 2004; Loureiro, 2012). González-Gaudiano (1999, 2000, 2002) emphasizes that information can contribute to improvements in what socially constitutes people’s lives when it contributes to their actions in their contexts.

Based on these premises, we describe the activities of information/education of knowledge developed by the members of NUPEDEA. It is important to emphasize that such activities have as the main purpose the empowerment of farmers. Therefore, we highlight the concept of empowerment. At NUPEDEA, we assume empowerment as a dynamic process that aims to increase the autonomy of people in their social contexts. It refers to individuals or groups facing conditions of oppression and/or social vulnerability. It seeks to develop a critical view and positioning to deal with adverse issues (Friedman, 1992; Narayan, 2002; Romano, 2002; Gohn, 2004; Horochovski; Meirelles, 2007; Wendausen; Kleba, 2009; Baquero, 2012). Empowerment corresponds to the process in which people construct conditions that allow them to have influence, capacity for action and decision to arbitrate on issues that concern themselves (Friedman, 1992; Narayan, 2002).

It is important to highlight that there are antagonistic positions about empowerment. Groups of authors such as Horochovski and Meirelles (2007) consider the intervention of external agents as fundamental for the empowerment of subjects. For another group of thinkers, including Friedmann (1992), empowerment can not be provided for a given group, since the subjects themselves are capable of empowering themselves.

We consider that both points of view are relevant and a synthesis of them is possible and desirable. Regarding external agents, we assume that they could act as initial catalysts in creating spaces or paths that support these processes. From this ideological position we have propose interventions in the community of farmers. Through the dialogue with these theoretical assumptions, which have guided our actions, we believe that critical environmental education favors the empowerment of farmers because the development of capacities for
identification, analysis and action correspond to fundamental aspects for intervention in situations that affect their lives.

From this perspective, we analytically present the context of farmers’ lives in agricultural production and the student actions up to the present moment.

3 THE CONTEXT OF THE FAMILY FARMERS’ LIVES AND THE UNDERGRADUATE CHEMISTRY STUDENTS’ ACTIONS

Previous to the analytical description of this topic, a brief characterization of the methodological aspects is necessary. As we have pointed out, attention to the site was sparked by narratives from the student who live in the community about the farmers’ practices. In the field, the findings on the life situations (risks) of the farmers guided the actions and the theoretical and methodological assumptions of the study. The research was developed alternating study meetings and action planning at NUPEDEA\(^1\), with its execution in the rural environment of the farmers. As already pointed out, the action-research was held at the farmers’ own workplaces and in the rural school of Joianopolis. We have adopted this format because we consider it favorable to the objectives we intend in the study.

Data collection was carried out by observation with field diary annotations, recordings, photographs and filming, questionnaires and semi-structured interviews (Ludke & André, 1986; Bogdan & Biklen, 1994; Flick, 2009). The Content Analysis Method by Bardin (2011) was used as well as the categorization. Quantitative analysis was also implemented.

We have mapped out the existence of 26 properties of small family farmers in the surroundings of Joianopolis. From these 26 families, 19 participated in the study, totaling 102 people involved. The number of adults directly responsible for

\(^1\) Part of the action-research happens at IFG Anapolis Campus. Periodic meetings are held at NUPEDEA for the discussion of the facts found in rural areas, and for studies of the theoretical frameworks that guide our analysis and performance. All activities developed with farmers are discussed previously by the group. These meetings have been become a rich forum for teacher education and planning of the intervention actions.
agriculture totals 59; 43 are young people, children or relatives who live and work in the plantations.

The questionnaires allowed outlining the socioeconomic characterization of the group. Each family consists of 4 to 7 members, 54% of them female and 46% male. All adults questioned and 68% of young people over 10 years of age work in agricultural production. Agriculture is the only source of income for all of the families and only 10% of adults own the land where they work and live.

The adults who work in the plantations are aged between 25 - 72 years, while the young people are in the age group of 12 - 19 years old. Regarding schooling, we learned that 67% of farmers have only elementary education (complete or incomplete). And among the young, we found that only 47% of those with a compatible age for high school are enrolled in this level of education.

From the reports in the interviews we found out that there are adults who have been working with the use of pesticides for over 30 years. Also, 53% of the young men mentioned that they have worked in agriculture with their parents since childhood in various activities: harvesting, preparing the land for planting, clearing land, spraying pesticides among other activities.

In the experience of the action-research in the field we have witnessed the indiscriminate use of various types of pesticides in the composition of pesticides and agricultural input blends. In general, we have seen the use of 8 to 12 different kinds of product. In some properties, we have faced the use of prohibited substances. Another worrying aspect was the contact with these products. As the predominant practice is crop rotation, we found that the frequency of exposure

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2 The gap between the ages of 19 and 25 is due to the exodus of these young people to Goiania, the state capital, in search of better jobs and living conditions. However, as it is common to migration processes, in the capital they are underemployed and resigned to other difficult conditions of survival. The difficulties added to the growing unemployment in the country have driven young people back to work in agriculture.

3 The dropout rate at the rural school is high and it happens mainly in the periods of application of the poisons and harvest of the production. Because these young people are the primary labor force in agriculture, many fail to reconcile the intensification of field work with school activities and choose to abandon it with the consent of the family.

4 We have come across the use of products that have been banned since the 1980s. To our surprise, we have found in some properties Aldrin, Dieldrin and even DDT, products of high toxicity, which are sold delivered on properties by dealers from Paraguay.
is high. 90% of the farmers usually apply the chemicals at least four times a week to fight plantation plagues.

We have observed situations of risk that range from the preparation of poisons to their application. We have seen on field visits that all farmers handle products without gloves, masks or goggles. They prepare the blends at the very application sites, which corroborate to contamination of themselves and of the environment.

Although this may seem to be commonplace, it is important to point out that the most dangerous situation occurs during the application of poisons. Farmers predominantly use a back pump. In some occasions we have also witnessed the use of a hose cart and attached manifold, and also the use of motorcycles and tractors with spray equipment.

The choice of equipment is given by the income of each farmer. As most of them face financial difficulties, the use of the back pump predominates. Despite the technical differences, we have observed that all equipment promotes a high level of contact with the chemicals, which is aggravated by the non use of PPE. In the periods that we followed the activities of the farmers, we noticed that at the end of the work, their clothes were soaked with poison, in direct contact with their skin. When asked about PPE use, 45% reported using it frequently. However, we have not seen this at any time during field visits. Only one farmer showed the apparatus, which had been stored and was almost new – we infer it had never been used.

During the conversations and interviews, many farmers reported symptoms of intoxication. 74% reported cases of intoxication after applying pesticides and highlighted symptoms such as itching, nausea, coryza, weakness, burns and redness on the skin. Even so, they still continue to use the products without proper protection and indiscriminately.

At the rural school, several students mentioned that they apply the poisons together with their parents. At various times we have come across these young men in the field. Another fact of impact was the presence of children at the plantation sites: joking, harvesting, clearing the spaces of the crop and handling
containers of pesticides. Many of them, on several occasions, were in the midst of spray fumes during pulverization.

In the reports, cases of people with various diseases in the family emerge, among them cancer. There is still no specific study confirming the relationship of this disease with the use of pesticides at the site. However, when we analyze the data from DATASUS (2016), it shows a high rate of cancer in the region.

The analysis of this scenario refers to the risk situations among farmers regarding the use of pesticides. In general, situations of vulnerability predominate, resulting from the lack of information about the products used. 95% of the farmers have never attended courses and/or lectures on the use/risks of pesticides. The information to which they have come from agronomists and/or salespeople from agricultural products shops or those in the package inserts.

We experience a reality constituted by ignorance and little (or no) commitment to what is essential for safety in working with pesticides. The conventional production form they adopt implies the use of poisons, whose form is described with some discomfort, which we consider related to the lack of safety information. The question "What should we do then?" was constant in several statements by family farmers.

Faced with this conflictive scenario, we intended to begin a process of empowering workers through the construction of contextualized knowledge. We consider information to be the main medium for it. In this way, we have developed didactic materials and organized meetings with the community, which were carried out by the undergraduate students.

The didactic material, structured as a brochure, was elaborated over a period of eight months in meetings at NUPEDEA. The purpose of this elaboration was to systematize the information in an accessible way, regarding toxicity, handling and safety in the application of poisons. The topics were contextualized in local situations and presented in an illustrated way.

The first educational meeting was carried out at the rural school of Joanapolis. The activity took place in a dialogical way, valuing students' practical
experiences. Groups were formed, in which students – the farmers’ children – exposed their doubts and experiences lived in the plantations.

Doubts arose on the reuse of packages and the composition of pesticides. However, the predominant ones were on first aid and long term effects of poisons. The students reported the same symptoms of intoxication mentioned by their parents.

The students were surprised by the information and affirmed they were unaware of the harmful effects of pesticides on human health. At the end of the activities, they asked us to go back to their school more times with new information. Many of them made themselves available to the field visits to multiply the orientation work with relatives and neighbors.

Success with the students led us to adopt the material with farmers. We prepared a meeting in the Farmers Association, with the same purpose: construction of knowledge to reduce risk situations. However, the activity only took place after a few failed attempts due to the absence of the farmers in the scheduled meetings. According to some justifications, the absence was due to fatigue caused by everyday labor. However, we learned that it also happened because of an unattractive school vision, in which the majority could not continue. In this way, we organized the meeting with farmers in the midst of festivities at the Association. This meeting happened successfully and was attended by approximately fifty people. The proposal was performed in a similar way as the one executed with the students. Farmers, in greater detail, reported their farming activities, from land preparation to pesticides use and the selling of their products.

These farmers demonstrated a lot of tacit experience with little in-depth knowledge about the activities they do. As we had already learned this, we aimed at addressing the properties and risks of the use of pesticides. The promotion of an environment of knowledge corresponded to our main purpose. We infer that it

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5 After individual visits for a period of ten months, all farmers involved in the study were invited to discuss the risks of pesticides. The first attempts at the rural school failed, as we could not get together more than six people. Reflecting on this situation brought us back to the unpleasant experiences these people reported when they attended school. Thus, we chose to hold the meeting at the Center of Rural Traditions of Joanapolis, where we discussed such issues in the midst of folk songs and typical foods.
was a rich learning moment for both parties: undergraduate students and community producers. After the initial resistances there was great exchange of knowledge in which the interlocutors shared what was not known by one other. In this context, we highlight the dimension of environmental education in which all are actors in the same education process (Sauvé, 2005a, b; Carvalho, 2012; Loureiro, 2012).

The perceptions about the involvement in the activity, with the exposure of the experiences in the application of pesticides, reports of intoxication cases, explanation of doubts, attention and value to the information conveyed, refers to the principle of a process of empowering farmers against situations ignored in their context. This process can take place through the development of the capacities to perceive the facts that surround them, to discuss and to decide on what concerns them (Saito, 2000; Reigota, 2004, 2009; Guimarães, 2004, 2007; Carvalho, 2012; Loureiro, 2012). The farmers’ participation in their social contexts, mediated by information and stimulation of critical thinking can lead to empowerment. We agree that this process is continuous and strengthened over time (Friedmann, 1992; Narayan, 2002).

In the action-research carried out, we have learned, until present the moment, aspects that would be favorable to the empowerment of the farmers. During the meetings we noticed the increasing interest in new information requested by several participants. Concerns have arisen over the establishment of a place for the reception of the study group on the days of visitation. Handling, disposal and application of pesticides was brought onto the spotlight. They are facts that point to a greater attention to the circumstances ignored until then. Although they are not ideal in this context, they indicate possibilities for changes in postures and for intervention in the situations of risks experienced by farmers.

We believe that these aspects are initial elements of a process to be strengthened. To this end, we seek the collaboration of other professionals (chemists, agronomists, biologists and sociologists) in the structuring of contextualized knowledge for the next stage of the study. In this way, NUPEDEA
intends to collaborate for the empowerment of these subjects, taking the critical perspective of environmental education as a theoretical-methodological basis.

4 CONCLUSIONS

When we set out to study the life context of the farmers in Joanapolis and faced the risk situations, then we decided to intervene in the process of critical environmental education, which we consider to be conducive to the promotion of knowledge, decision-making and changes in attitudes towards this reality. Knowledge of the field of action-research was fundamental for the purpose of empowerment by environmental education, since it allowed us to grasp the preeminent needs in this context. This familiarization was the goal of the activities planned in the Center of Research at IFG, executed by the undergraduate students.

Flexibility in the execution of activities was an important factor. We noted that the structuring of the proposals to farmers' daily life facilitated the dissemination of information. Their attention was gradually aroused, which favored the relationship between students-farmers. In this contact, we infer that individuals are subjected to conditions of social vulnerability to the use of pesticides, mainly due to the lack of consistent knowledge, which allows the selection of less toxic products, handling/applications and discards with less risk.

Learning that farmers acquire poisons based on the recommendation of others or based on their tacit experience has enabled us to confirm, in accordance to the answers in the questionnaire that they have little access to systematized knowledge about toxicity, proper forms of handling and level of contamination that pesticides can cause.

Based on these evidences and the theoretical and methodological references, we affirm that the construction of contextualized knowledge can collaborate so that these people are empowered in the situations of risks that they experience daily.

We emphasize that the critical perspective of environmental education contributes to this process. Surprises on the behalf of farmers in relation to risk
situations show that, although it is part of their daily life, they are unknown to the majority. This perspective can be a means of recognition.

These findings refer to the assumptions of the necessary identification of the problems in a given social context, for the intervention of the subjects. We emphasize that the ability to identify is the first step in the processes of empowering people against adverse situations in life. We believe that the requests for information and questions that emerged during the meetings result from this perspective started. The awakening of the attention to the situations of risk is the main aspect of stimulation by information and questions. From these facts, we think that critical environmental education can constitute a process capable of providing subsidies to address local issues. The development of the capacities to identify, to problematize and to act can be a way for the intervention in risk situations in the community of farmers (Guimarães, 2004, Reigota, 2009, Carvalho, 2012; Loureiro, 2012).

Based on these assumptions, we point out that the education process can contribute to the development of less harmful practices for farmers. We believe that contextualized knowledge together with actions in the face of risk situations are favorable to changes in the situation experienced by these people.

The rural school is an important place in this scenario. We consider that it constitutes a potential space for the construction of knowledge and development of actions. The request for new information from the students about pesticides and the willingness to collaborate in the dissemination of information points at the possibility of more effective interventions in the whole community.

Another positive aspect within the scope of the educational spaces was the interaction of the farmers with the Chemistry students in the meetings organized. The analysis of the filming of these activities allowed us to infer that they were important moments of learning for both parties involved.

In relation to these meetings, a specific analysis of teacher education through environmental education will be detailed in another article. However, we can already anticipate that these processes, with their complexity and diverse interferences, have promoted the development of teaching beyond teaching-
learning concepts. Located in the socio-environmental dimensions of space, we have perceived the construction of critical and active teaching in contemporary dilemmas.

As a conclusion, we emphasize that the empowerment of the subjects is one of the main ways to face the risks of the use of pesticides. We realize that this process will be slow and will happen gradually throughout systematized work. In this regard, NUPEDEA intends to continue studies and stimuli as initial catalysts. The social intervention of the Center will happen by actions in the promotion of knowledge changes of postures in the small farmers in situation risk by the use of pesticides.
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