APPROACH ON VEGETATIVE PROPAGATION *in vitro* FOR THE EDUCATION OF SCIENCES IN PUBLIC SCHOOL IN THE MUNICIPALITY OF BENJAMIN CONSTANT-AM, BRAZIL

Abordagem sobre propagação vegetativa in vitro para o ensino de ciências em uma escola pública no município de Benjamin Constant-AM, Brasil

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Abstract

This work presents a description of the research carried out in a public school in the municipality of Benjamin Constant-AM, in which the technique of *in vitro* vegetative propagation was discussed. The primary and secondary school community participated in this research. The techniques of data collection used were: questionnaire application before and after the regency for the high school classes; Participant observation; Informative seminar on the subject vegetative propagation *in vitro*. The results indicate that the majority of the students were interested in understanding the content that was proposed to minister. In addition, it is believed that the students obtained logical-deductive reasoning that allowed them to identify and consequently solve problems / problems of *in vitro* cultures and with this to awaken possible practices from this technique, since this practice is not limited to only a medium of interest that can be thought in the environmental, food and / or economic issue, besides being able to be developed as a pedagogical research project in the school context.

Keywords: Tissue Culture, Teaching, Biotechnology.

Resumo

Este trabalho apresenta a descrição de pesquisa realizada em uma escola pública no município de Benjamin Constant-AM, no qual se abordou a técnica de propagação vegetativa *in vitro*. Participou desta pesquisa a comunidade escolar do ensino fundamental e médio. As técnicas de coletas de dados utilizadas foram: aplicação de questionário antes e após a regência para as turmas de ensino médio; observação participante; seminário de cunho informativo sobre o assunto propagação vegetativa *in vitro*. Os resultados apontam que houve o interesse dos alunos em sua maioria em compreender o conteúdo que se propôs a ministrar. Além disso, considera-se que os alunos obtiveram raciocínio lógico-dedutivo que lhes permitiu a identificação e consequente resolução de questões/problemas de culturas *in vitro* e com isso despertar possíveis práticas a partir desta técnica,

uma vez que esta prática não se limita a apenas um meio de interesse podendo ser pensada tanto na questão ambiental, alimentar e/ou econômica, além de poder ser desenvolvido como projeto de pesquisa pedagógico no âmbito escolar.

Palavras-chave: Cultura de tecido, Ensino, Biotecnologia.

Introduction

Currently, a branch that grows in the area of Biotechnology is the Technique of Vegetative propagation in vitro or Micropropagation, being diffused, mainly for its large scale production efficiency, in order to grow plants for economic / financial purposes. In addition, it involves other areas of study, such as Biology, Chemistry, Sciences, Environmental Education.

In this way, this work will approach this technique in the school context, starting from the principle of its application or even of its importance for the environment, economic and social, because, it is noticed that there are many advantages, for example, seedlings that will serve to planting in relation to large-scale development, in order to intervene in the quality of the farmer's production, bringing him better expectations of family income.

This technique is important, therefore, involves tissue culture, and approaching students is paramount, since there are possibilities to conserve plant species to future generations and present employment proposals through the technique with intervention of students / teachers from other institutions, be it municipal, state or federal public or private that are not directly linked to secondary schools, but that promote the mediation of knowledge.

So addressing the technique of vegetative propagation *in vitro* is to make mention of the conceptual part. For Vilela (2003) Cell Culture Technique consists of cell growth with appropriate nutrients in large bioreactors. Plant cell culture is essential for biotechnology because it is based on the unique property of these cells, the totipotency, to generate a multicellular plant from a single differentiated cell.

In standard micropropagation schemes, in vitro propagation development stages are made up of phases that include "selection of explant and production of contaminant-free cultures, multiplication of vegetative propagules, rooting and acclimatization in the *ex vitro* condition of plants obtained *in vitro*" (Brazil, 2013).

However, it is essential that teachers work on these concepts in the classroom, because it is perceived that these are limited to only some individuals who work in the area of environmental education, for example, as it points out (Dias, 2004) "Concern for the environment, however, was still restricted to a small number of scholars and nature lovers - spiritualists, naturalists and others."

According to the Ministry of the Environment (2017), concerns about collecting treatment and disposing of solid waste represent only part of the environmental problem. It is worth remembering that the generation of waste is preceded by another impactful action on the environment - the extraction of natural resources. The 5R's policy should prioritize the reduction of consumption and reuse of materials in relation to their own recycling: Reduce, Rethink, Reuse, Recycle, Refuse to consume products that generate significant socio-environmental impacts. The 5R's are part of an educational process that aims to change habits in the daily lives of citizens. The key question is to get the citizen to rethink their values and practices, reducing over-consumption and waste.

The R's principle is linked to the issue of environmental education, since, with the technological advance and increase of solid waste accumulation, it is associated with issues that include guidelines for prior care with the natural environment. "The current situation is marked by greater concern with the issues of defense and protection of the natural and built environment (especially of historical and artistic value), climate change and risks socio-environmental "(Brazil, 2013).

Although this theme is considered by many to be inappropriate for high school students, this in turn holds the opposite direction, because nowadays it becomes paramount that students of the institutions are inserted into research projects to be co-authors of solutions of problems that mainly affect the natural environment.

Marconi; Lakatos (2010) mentions that new requirements require a new behavior of teachers who must stop being transmitters of knowledge to be mediators, facilitators of the acquisition of knowledge; should stimulate research, knowledge production and group work. This necessary transformation can be translated by the adoption of research as a pedagogical principle.

It is worth mentioning that the micropropagation technique allows the production and distribution of seedlings free of pathogens, that is, of diseases. For this reason, the objective was to make an approach on the subject of vegetative propagation in vitro in relation to the concepts that involve the technique for high school students, since studies on this subject are scarce in the state of Amazonas, since with the accelerated production of knowledge, schools take up the challenge of doing subjects such as these being socialized in order to promote the raising of the level of education of the population, once inserted in pedagogical research projects.

Materials and methods

Study area and target audience

This research was developed at the Immaculate Conception State School. The school has 42 teachers in class regency, one of which has a master's degree and the other teachers have specializations in different areas of teaching. Currently, the school attends 36 regular high school classes comprising 1st, 2nd and 3rd grade classes, totalizing 1,030 active and regularly enrolled students in the current year of 2017. Therefore, the school community participated in this study, which included two classes of the 2nd totaling 28 students.

First, it was asked to authorize the teachers of the school and then to the direction of the said school. The project was then presented to the students' representatives using formal dialogues and the Informed Consent Term (TCLE) in accordance with Resolution No. 466 of December 12, 2012 of the National Health Council (BRAZIL, 2012), taking science and those who agreed to participate in this research, signed the term.

Types of research

Researches of bibliographic, descriptive and intensive direct observation (Marconi and Lakatos, 2009) were carried out. For Martins (2008), the bibliographical research is the type of research in which the researcher looks for printed or electronic sources, (internet), or in the literature the knowledge that needs to develop a certain theory. In this sense, the bibliographic research posed several possibilities for the researcher to deepen the study through several sources. This process of reading was carried out during the whole stage of elaboration of the theoretical reference and in the analysis of the results.

This stage of the research is relevant, being able to know works carried out on the subject studied, to base it theoretically and to acquire new ideas, allowing the researcher a deeper insight

into the subject, thus answering his questions. In addition, the qualitative and quantitative approach was used.

In this sense, Marconi; Lakatos (2010) explains that the qualitative approach is a research whose premise is to analyze and interpret deeper aspects, describing the complexity of human behavior and still providing more detailed analyzes on the investigations, attitudes and tendencies of human behavior.

Following this line of thought, Minayo (1994) states that qualitative research responds to very particular questions because it works with the universe of meanings, motives, aspirations, beliefs, values and attitudes. This set of human phenomena is understood here as part of social reality, because the human being is distinguished not only by acting, but by thinking about what he did and interpreting his actions within and from the reality lived and shared with his fellows.

However, qualitative research is a method of scientific investigation that focuses on the subjective character of the analyzed object, that is, it seeks to identify the characteristics of the research participants, thus emphasizing their values, beliefs and attitudes within the social reality lived by they. This type of approach allows interviewees the freedom to express their ideas and thoughts on certain subjects that are related to the object of study.

In this sense, when performing the qualitative research, it is expected to be able to understand the behavior of a certain target group, studying their particularities and individual experiences.

Instruments for data collection

The techniques of data collection used were: 1) Application of questionnaire with questions semi-structured before and after the regency for the high school classes; 2) Participant observation; 3) An informative seminar on the subject of in vitro vegetative propagation.

According to Minayo (1994), the semi-structured interview makes a combination of open and closed questions allowing the flexibility that will guide the questions to be asked. At this stage we will conduct the interviews with the educators, in addition, we will make the direct observation that is necessary to analyze the environmental perception that these educators present on the environmental issues and their influences in the educational process.

For more information about the topic, it was necessary to observe the participant, with a duration of 60 hours, where the researcher sought to observe the students and teachers in relation to the conviviality, contextualization and different ways of teaching the contents learned in the classroom.

The participant observation was and always will be very important, because it enables the researcher to insert himself in the context of the research object investigated. This consists of the actual participation of the researcher with how much a member of the group who is studying and participating in the normal activities.

Stages of execution

First, a questionnaire containing 10 questions with open, closed and mixed questions was applied in order to obtain information about their knowledge or not about the subject in question, since many students of the school quoted during the observations, conducted during the supervised stage, distorted facts about the propagation of plants.

It was questioned: 1- Gender, Class, Turn ?; 2- Age ?; 3- Have you ever heard of *in vitro* vegetative propagation or micropropagation ?; 4- For you, what would be vegetative propagation *in vitro*?; 5- Check the question that you consider to be true, *in vitro* vegetative propagation is: a) Aging of plant tissues, b) Inorganic products that pass through laboratory technology and become beneficial to living beings, c) culture of cells, tissues and organs in nutrient medium and conducted in vitro under aseptic conditions; d) Inability of the plant organism to adapt to the new conditions imposed by internal stimuli or external environmental aggressions; 6- Do you know the 5R's of the environment ?; 7- In your opinion, what is the importance of following the 5R? 8- Describe some plants of the region that for you, have economic potential; 9- Do you know what biosecurity is?; 10- Other comments.

This phase of research has become important in collecting prior information on the field of interest in vitro vegetative propagation. While the participant observation of this work happened in the execution of this project, it had the objective of knowing the knowledge conditions of the students, as well as the difficulties presented during the execution of the works.

An expository class was held in the form of a seminar using multimedia resources, addressing the conceptual part, advantages and disadvantages and technique used in the process of plant production. This approach aimed to provide better clarification to students based on the basic concepts of biosafety and methodologies and techniques used in the field of cell and tissue culture. To facilitate the understanding of the terms, the use of images and with a language accessible to the youngsters was prioritized, showing the importance of this area in a current context for food production (agriculture) and preservation of the environment.

At the end, a video titled "notions of biotechnology" was available at www.youtube.com by Marco Antonio, for information on the main techniques of in vitro culture, cell multiplication, plant genetics and transgenic. Then, a questionnaire containing 10 questions with open, closed and mixed questions was applied in order to verify the understanding of the students and to make a diagnosis through the satisfaction or not about the content approach to the same.

The school of this instrument was given because it is possible to retrieve information about the research object in a practical way due to its flexibility at the time of its application. For Chizzotti (2008) the questionnaire consists of a set of questions pre-elaborated, systematically and sequentially arranged in items that compose the theme of the research, with the purpose of raising from the subjects involved written answers of the researched subject.

The questions were: 1- What did you think of the content covered; 2 - Do you agree that the technique of vegetative propagation in vitro or micropropagation, has commercial importance for the municipality? 3- In its conception is the technique of vegetative propagation in vitro beneficial or harmful to human health ?; 4- What are the 5R's of the environment ?; 5- Mark the question that you consider to be true, the in vitro vegetative propagation is; 6- Cite two advantages and two disadvantages on the technique of vegetative propagation in vitro; 7- In one sentence characterize the technique of vegetative propagation in vitro; 8- The technique of vegetative propagation *in vitro* consists of culture of cells, tissues and organs in a nutrient medium and conducted *in vitro*, under aseptic conditions. This statement is; 9- How important is it to use the technique of vegetative propagation *in vitro*?; 10- Other comments.

All data collection steps were performed through the observations made at school and through informal conversations with teachers, school managers and students, and the questionnaires were analyzed through content analysis. This will be done through the qualitative approach and

based on Vasconcelos methodology; Souto (2003), which establishes four priority axes: theoretical content, visual resources, proposed activities and additional resources and their analysis criteria.

After the general reading of the materials, the units of analysis were grouped into categories constructed during the analysis, and these are grouped in some subtopics that are organized in the results.

Results and discussions

It was concluded that the profile found among male students was 57.1% and female 42.9%. Students between 17-29 years of age, arranged as follows: 17 years (7.1%); 18 (14.3%); 19 (17.9%); 20 (14.3%); 21 (10.7%); 22 (10.7%); 23 (3.6%); 24 (7.1%); 25 (3.6%); 27 (3.6%); 28 (3.6%) and 29 years (3.6%).

Regarding the age group of the students, all according to the National Youth Council (CONJUVE) are considered young, therefore, they are subjects with age between 15-19 years, being thus, to approach the subject discussed to the same becomes a relevant one as they are individuals capable of critically opining, and "perceiving them as subjects with values, behaviors, worldviews, interests and unique needs. In addition, one must also accept the existence of common points that allow it to be treated as a social category "(Brazil, 2013).

Description of the previous knowledge about the subject proposed to the classes of High School Initially, it was important to know the students' perceptions about the subject, as well as others related to the subject, since, in terms of research, it is important to obtain a panorama of the field of interest that one intends to work on. Thus, we inquired of the respondents whether or not they had knowledge about the technique of vegetative propagation in vitro or micropropagation, according to the students' responses was unanimous in stating that they did not know what it was.

When questioned about what they knew about the 5R's of the environment, of 100%, 96.4% of the students demonstrated not knowing such information. The result is worrisome, because they point out that the students do not know basic principles about the preservation and preservation of the natural environment, but in parallel talk, when asking if they knew the 3R's of the environment, there were mention of some. It is believed that this lack of information is a consequence of the recent updating of these 5R's principles.

The students were asked whether they knew the concept or something related to biosafety, and all answered that they did not know. It has become important to question students since this technique is directly related to the practical aspect of the laboratory, a process that will be essential to maintain the development of the plant species with good quality and far from pathogens.

This lack of information may be due to the lack of effective participation of teachers in courses that require experimental practices, as emphasized (Malajovich, 2009), since few of the newly trained teachers have had experience in research laboratories where they have applied new technologies or monitored its use. So the vast majority have limited practical knowledge, stemming from theoretical discussions at specific points in the formation.

To improve the explanation and in order to know the branch that involves biosafety (Carvalho et al., 2009), it is considered a science that studies and develops actions for the safety and protection of professionals who carry out in their activities the manipulation of contaminated materials "and that pose a risk to their health and that of others due to improper conduct regarding the use of equipment and materials of the work or teaching environment.

After the application of the previous questionnaire, subjects related to the importance, benefits, harms, biological and chemical factors involving the technique of in vitro vegetative propagation were approached through a presentation in the form of a seminar by the author of this work.

It was necessary to approach the student class this technique of vegetative propagation in vitro linked to some thematic axes regarding the preservation, conservation and maintenance of the Amazonian forest. Since in the application of the previous questionnaire, it was felt the need to address this issue in more depth because we live in the Amazon and we need to preserve for the future without depleting the available natural resources. Therefore, to minimize the increase of the biograding and extinction of species of the region, in order to promote the application on the technique and increase the production of seedlings, besides making possible the appropriation of knowledge in the areas of Sciences.

For Meirelles-Filho (2004) the word biogrilagem is more adequate than "biopiracy". Biograding is becoming one of the most serious problems in the Amazon. The numbers of seizures and evidence of biograding have grown a lot. It is important to mention the issue of bio-gravel, since it is directly linked to the extinction factor, since it involves the illegal use of many plant species, such as: Brazil nut tree (*Bertholletia excelsa* L.) and Andiroba (*Carapa guianensis* L.) illegal, and treating this matter for the student class is essential, because, one can notice a significant increase in biograding, that is, the traffic not only of animals but of plants.

Thinking about problems like this is that it was necessary to approach the applicability of the technique of vegetative propagation *in vitro* to the high school class, and motivate them to find solutions that minimize this effect through research. It is worth mentioning that "motivated and teacher-oriented school research implies the identification of a doubt or problem, the selection of information from reliable sources, the interpretation and elaboration of this information, and the organization and reporting of acquired knowledge" (Brazil, 2013).

Regarding the application of the regency, it can be observed that there was little participation of the students in the moments when it was requested, as for example, in the examples that were applied in daily life and even discussing about this subject with respect to environmental preservation, they were interested in knowing the subject that they proposed to minister.

Analysis of post-content questionnaires to high school classes

This phase of the intervention became paramount in terms of knowing the students' use or not about the subject addressed during the regency, in which the basic concepts that involve the micropropagation technique were emphasized. For this reason, the students were initially asked to (53.6%) found the content interesting, 39.2% considered the subject to be good, and 7.2% cited this relevant technique.

It is believed that students were satisfied to know the importance of the technique for the conservation and preservation of plant species for future generations, and to enable students to be co-responsible for actions that contribute to these factors. The truth of this question can be verified when the students were asked if this technique had or did not our region, where the majority (75%) said yes and 25% answered that this technique does not have any importance for the environment.

It was verified that the micropropagation technique was exemplified by the students, since the majority (54%) were able to assimilate the importance of the subject with the Amazon forest as it comprises a vast and rich vegetative territory, natural riches that contribute directly for the

survival of the "riparian" of the region, so it is necessary to maintain its maintenance, conservation and preservation.

"The importance of the Amazon to humanity depends on the maximum maintenance of the environments in their original state. As most of it is covered by forests, it is a clearly forestry vocation "(Meirelles-Filho, 2004).

It is known that this content is new to the students' knowledge, and the regency contributes with basic notions of micropropagation, allowing some students to have notions of the principles that guide their applicability. If necessary, the implementation of new intervention projects so that all students can effectively understand its applicability. Thus, they questioned the same conception they would have about applicability, in that it was noted that 88.6% said to be beneficial and 11.4% said to be malefic.

In fact, the regency contributed so that the students could know more about the technique of micropropation making possible the increase in the life expectancy of the seedlings that are developed in nutrient culture medium and outside of pathogens, it is worth mentioning its value to the market, most species of plants have economic value, and in the Amazon region the flora is abundant for future generations, and according to the students' responses, there are plant species that have economic value but are not valued as açaí (*Euterpe oleracea* L.), Brazil nut (*Bertholletia excelsa* L.), camu-camu (*Myrciaria dubia* L.), among others.

It is known that the main source of food comes from the forest through agriculture, from manual planting. For Borém (2008), "the great plant richness is composed of trees, pteridophytes, epiphytes, thousands of plants, many of which are not yet classified or known (where active principles of new medicines can be found)."

The teaching-learning process focused on environmental issues is of the utmost importance, since it can help to transpose the rooting of the culture of environmental degradation, education can and must counteract the unconscious thought of the indiscriminate use of renewable and nonrenewable natural resources , within a vicious circle of degradation and avoiding a possible environmental collapse, which would be the lack of the natural resources necessary for the permanence of man from his natural habitat on planet Earth.

Thus, the school is a space of construction and formation of social and human conduct, where all forms of cultural and social expression from society are found as if it were a subjective reflection of human actions, society exerting a strong influence on the but the school is the only structure capable of being able to change social paradigms, to free the subject from the alienated common sense, to the reflexive and critical subject of social practices.

On the other hand, when asked to choose the correct assertion about the technique of vegetative propagation in vitro or micropropagation, it was noticed that the majority of the students (57.2%) answered correctly the conceptual question of the which is: "a technique that involves cultures of cells, tissues and organs in a nutrient medium and conducted in vitro under aseptic conditions. However, 35% of the students answered that this technique results in products inorganic that pass through laboratory technique and become beneficial to living beings and 7.8% did not respond. It is noticed that with the analysis of the answers, that a small amount of students could not assimilate the concept with the practice. Perhaps this may be related to the lack of contextualization of content and to the lag during elementary education with the study of botany during the discipline of science.

Biology teaching can still be a challenge for many teachers and students today. In general, students are dissatisfied because they believe that Biology is a difficult discipline, since it requires a great capacity for memorization, due to the numerous theoretical contents addressed in the school day-to-day (Castro, Goldschmidt, 2016).

In this context, practice is fundamental so that students can understand, interpret and draw their own conclusions from certain experiments. Facing Brazilian biodiversity, plant species are being used in practical classes to facilitate understanding in a contextualized way (Cavalcante et al., 2018).

It is noticed that a majority (78%) of the students took advantage of knowing the new content, this is related in conserving species that are in extinction to new generations, on the other hand, even with the execution of activities as well as the theoretical lecture and informative video of the procedure of the technique, there was little involvement on the part of the students in knowing the importance of using the technique of vegetative propagation *in vitro*.

With the advancement of technology as well as the popularization of science through contemporary media, subjects associated with genetic engineering, DNA testing and even plant biotechnology are subjects present in the daily lives of many students and that these need to be well explored and contextualized. Therefore, it is necessary to use the textbook more frequently in this context, since for Abreu et al. (2016) the textbook is understood as a book written with the intention of being a didatized version of knowledge for school purposes and / or for the purpose of value formation. That is, it is not only a school didactic tool, but also an instrument for the critical reflection of subjects present in the daily life.

With this, teachers, parents and the school community should encourage their students to master biological knowledge in order to understand the current debates and thus participate actively in this teaching-learning process. According to the National Curricular Parameters (NCPs), in the middle school, assimilation of codes, nomenclatures, and concepts are methods that should serve to broaden the possibilities of understanding and effective participation in the contemporary world, since this learning.

In addition, knowledge about both propapitation and practical concepts as the principles of the 5R's few students knew. Becoming a very simplified knowledge and little discussion on the part of the students. So this research ultimately served as a contribution to the students' understanding of a technique that could in the long run enable many species of plants not to become extinct. And also, that research may arise that works with this technique not only in theory, but also can be carried out and thus the prevention of the species is carried out for future generations.

Conclusion

This research was primordial for the formation of new knowledge for the students, once one can collaborate in relation to the dissemination of the knowledge. In addition, assimilation and efficiency of the technique of vegetative propagation in vitro and could have insight on the importance of the technique for the production of vegetable seedlings, besides developing notions of laboratory performance since these seedlings are kept first in laboratory until a certain time in order not to contaminated and which may develop away from pathogens.

It is believed that they have obtained logical-deductive reasoning that will allow them to identify and consequently solve problems / problems of in vitro cultures and thereby awaken possible practices from this technique, whereas this practice is not limited to only one medium of interest can be thought in the environmental, food and / or economic issue.

It is suggested that schools insert projects that can work on issues such as this, such as the insertion of a nursery of plant species in order to address issues such as the 5R's of the environment, even if they do not carry out the experimental practices of the propagation technique vegetative, but that the students have a notion of the importance of plant species to the region as well emphasized in their answers through the questionnaire, and even that, sensitize the institutional body of the school for practical situations of preservation conservation of the natural environment.

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