Multi-thematic workshops: Students as protagonists in the popularization of science in Feira de Santana - BA

Oficinas multitemáticas: Estudantes como protagonistas na popularização da ciência em Feira de Santana - BA

Talleres multitemáticos: los estudiantes como protagonistas de la divulgación científica en Feira de Santana – BA

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RESUMO

Objetivo: estimular estudantes a serem protagonistas de ações que fomentassem na sua comunidade a popularização das ciências através de oficinas pedagógicas temáticas, colocando-os como construtores dos saberes, assim como, fortalecendo o papel extensionista da Universidade. **Método:** As atividades tiveram a participação de 80 alunos e foram desenvolvidas no Departamento de Ciências Biológicas (DCBIO) da Universidade Estadual de Feira de Santana (UEFS), pelos docentes do NUPEECBio, discentes e monitores. Foi realizada na SNCT (2019) com estudantes do Ensino Fundamental (6° e 7° ano) utilizando oficinas multitemáticas em Ciências. Após essa etapa, foram aplicados questionários e a avaliação qualitativa usando a Escala Likert para realizar uma avaliação qualitativa sobre a participação e adesão dos estudantes. **Resultados:** A análise dos dados em conjunto nos permitiu avaliar o grau de satisfação, percepção e cognição dos estudantes após cada oficina, demonstrando que as estratégias utilizadas foram exitosas. **Conclusão:** nessa experiência de interface Universidade e Escola básica, foi possível perceber a relevância da junção de atividades teóricas/práticas por meios de oficinas interdisciplinares no despertamento de curiosidade, motivação e receptividade dos estudantes.

Descritores: Ensino de Ciências; Oficinas dialógicas; Interdisciplinaridade; Universidade.

ABSTRACT

Objective: to encourage students to take the lead in actions that would promote the popularization of science in their community through themed pedagogical workshops, placing them as builders of knowledge, as well as strengthening the university's extension role. **Method**: 80 students took part in the activities, which were carried out at the Department of Biological Sciences (DCBIO) of the State University of Feira de Santana (UEFS) by NUPEECBio teachers, students and monitors. It was held during SNCT (2019) with elementary school students (6th and 7th grade) using multi-thematic science workshops. After this stage, questionnaires and the Likert Scale were applied to carry out a qualitative assessment of student participation and adherence. **Results:** Analyzing the data together allowed us to assess the degree of satisfaction, perception and cognition of the students after each workshop, demonstrating that the strategies used were successful. **Conclusion:** in this experience of the interface between university and elementary school, it was possible to see the relevance of combining theoretical/practical activities through interdisciplinary workshops in arousing curiosity, motivation and receptivity in the students.

Descriptors: Science teaching; Dialogic workshops; Interdisciplinarity; University.

RESUMEN

Objetivo: incentivar a los estudiantes a protagonizar acciones que promuevan la popularización de la ciencia en su comunidad a través de talleres educativos temáticos, convirtiéndolos en constructores de conocimiento y fortaleciendo el papel de extensión de la universidad. **Método:** 80 estudiantes participaron en las actividades, que se llevaron a cabo en el Departamento de Ciencias Biológicas (DCBIO) de la Universidad Estatal de Feira de Santana (UEFS) por profesores, estudiantes y monitores de NUPEECBio. Se llevó a cabo durante el SNCT (2019) con estudiantes de la escuela primaria (6º y 7º grado) utilizando talleres de ciencias multitemáticas. Después de esta etapa, se aplicaron cuestionarios y la Escala de Likert para llevar a cabo una evaluación cualitativa de la participación y la adhesión de los estudiantes. **Resultados:** El análisis conjunto de los datos nos permitió evaluar el grado de satisfacción, percepción y cognición de los alumnos luego de cada taller, demostrando que las estrategias utilizadas fueron exitosas. **Conclusión**: en esta experiencia de interfaz entre la universidad y la escuela primaria, fue posible constatar la importancia de la combinación de actividades teórico/prácticas a través de talleres interdisciplinares para despertar curiosidad, motivación y receptividad en los alumnos.

Descriptores: Enseñanza de las ciencias; Talleres dialógicos; Interdisciplinariedad; Universidad.

Introduction

The interaction between the levels and modalities that make up the National Education System has been highlighted as a fundamental action, both by public policies and by sectors of society, as it is linked to the processes of democratization, access, permanence and quality of education. In this sense, extension has been approached as a way of returning to society what it invests in the university, as a way of correcting the absence of communication and intervention of the university in society's problems.[1]

Science teaching is becoming an increasing challenge today, considering the generational differences between students and teachers. Linked to this temporal dynamic, new technologies and pedagogical actions have changed the ways of teaching and learning. According to Anastasiou (1998)2, one of the fundamental intrinsic elements of this learning relationship is the constant discussion of teachers' assertive pedagogical strategies regarding the action of teaching and learning.

In public schools, the teaching of science in the final grades of elementary and high school is usually constituted by structural and social difficulties faced in the teacher/student relationship. Currently, despite the wide access to information through the internet, which provides attractive, innovative and motivating technological resources, fundamental in the teaching and learning process of these students, the fragility in the practical contextualization of daily life and its application is remarkable. Formal educational praxis has been accompanying this new strand of "digital education", and in this context, the construction of an extramural, adequate and qualified learning environment is a great challenge for public high school institutions. Teaching practice in schools should be considered a means to broaden students' understanding of these contemporary realities, providing them with the tools for their decisions and interventions in the world around them.[3]

In line with the Cross-Cutting Themes established in the National Common Curricular Base (BNCC), as defined in the Law of Guidelines and Bases of National Education (LDB, Law 9394/1996), related to health and the environment, there are issues that must be worked on in an inter/multi/transdisciplinary way, enabling the "construction of new knowledge, techniques and knowledge and their incorporation with school contents".[4]

In this context, studying science in an integrated way is fundamental for the student's motivation, since it provides the development of significant learning. The contents of human health and environment in elementary school, which make up the disciplines of Biology, Chemistry and Physics, are worked in an interdisciplinary way in elementary and high schools, present in the great curriculum of the so-called natural and earth sciences.[5] In this way, the use of educational-cognitive events has become a common praxis of NUPEECBio. which has as its pedagogical proposal the non-dissociation between theory and practice in student training.

The application of extension actions in the form of workshops in teaching is a potential strategy for learning, being an active process of reciprocal transformation between subject and object, instigating the continuous search for knowledge.[6,7] Thus, the use of integrative methodologies between University and School can arouse interest in interdisciplinary knowledge, assisting in the teaching-learning process, being a methodological tool to make the teaching of science pleasurable and attractive, in addition to facilitating the understanding of its contents and practical applications.

During the National Week of Science and Technology (SNCT), multi-thematic workshops were held with the objective of carrying out integrative practices that are fundamental to educational training. It became essential to promote actions, attitudes and possibilities that would develop an integrated understanding of the spaces of the University and the school communities, aiming at a joint experience between teachers and students.

The proposal culminated in the realization of several workshops of an interdisciplinary and participatory nature, involving the dialogue between University and Basic Education, based on the use of multiple methodological tools with the objective of stimulating the imagination, creativity and critical thinking of students, placing them as builders of knowledge, as well as strengthening the extension role of the University. In this context, teaching strategies: synesthetic, digital and playful are fundamental means and resources for the successful consolidation of knowledge. In this way, in a multidisciplinary and interprofessional character, the themes of Science and Biology were integrated with the concepts of Health, Biodiversity and Sustainability, seeking to unite theory and practice in the workshops and demonstrate that practice is not dissociated from theory, or vice versa, and that the teaching of Science can and should be a creative, collaborative activity. Enjoyable and accessible to all.

Method

The activity was developed at the Department of Biological Sciences (DCBIO) of the State University of Feira de Santana (UEFS), with NUPEECBio professors and students from the Bachelor's and Bachelor's Degree courses in Biological Sciences and from Graduate Programs in Biological Sciences in the practical laboratories of DCBIO. The proposal included the participation of 80 elementary school students (6th and 7th grade), with 40 participants per shift, at the opposite time to the regular class, where each student participated in at least three workshops. The participating school was the Ernestina Carneiro State School (EEEC), in the city of Feira de Santana-BA.

The event took place during the National Week of Science and Technology (SNCT) in 2019, with the following activities offered: theoretical/practical workshops in the areas of Human Anatomy, Human Physiology, Biochemistry, Genetics and Molecular Biology, Botany and Immunology.

The workshops were presented through participatory activities using various tools, through active methodologies, placing the students as protagonists in the teaching/learning process developed by the students and participating monitors.

Workshop one, "Journey to the Human Body" (Human Anatomy Area), used macro models, models, physical games and human pieces from the UEFS collection. For the teaching, a conversation circle was initiated between the teacher, monitors and students, investigating the previous knowledge for later approaches. After this stage, several tools were used for the presentation of the constituent systems of Human Anatomy, simultaneously creating a dialogued exposition of the perceptions experienced, seeking a practical application of the content addressed, resignifying their previous knowledge.

Workshop two, "Why High Blood Pressure is Harmful to Health" (Human Physiology Area). The cardiovascular physiology workshop began with a circuit of anthropometric measurements (Blood Pressure, Heart Rate, Respiratory Rate, BMI, Weight, Height, Body Circumferences and Blood Glucose).[8] After this stage, an educational/participatory process was provided, favoring the cognitive consolidation of students with an interdisciplinary focus on health promotion activities in the field of physiology.

In workshop three, "Unraveling the Role of Chemical Elements in the Human Body and the Environment" (Human Biochemistry Area), the molecular constituents of human cells (proteins, carbohydrates, lipids, nucleic acids and chemical elements) were presented through the application of a memory game, Memochemistry. The activity was developed in teams with the participation of the students, discussing the benefits, utilities and dangers of some chemical elements found in nature. To fix the contents addressed, a Quiz was applied, recalling the concepts and examples previously worked.

During workshop four, "Playing Geneticist: discovering DNA" (Genetic and Molecular Biology Area), it began with a brief theoretical exposition of the knowledge about genetics and heredity, in which the molecule associated with such characteristics was DNA. After this dialogued exposition of the content, the students highlighted the chromosomes as the elements that contain all the genetic information. The practical part of the workshop involved the extraction of DNA from different plant sources (strawberry and banana) demonstrating its presence in eukaryotic cells.[9]

Workshop five, "Knowing Plants: Diversity and Importance" (Botanical Area) had a previous dialogued explanation about everyday plants presenting four groups of existing plants: Bryophytes, Pteridophytes, Gymnosperms and Angiosperms. The experience experienced by the students included the observation of the exhibited species with the help of equipment such as magnifying glasses and microscopes, in addition to the tasting of some fruits after their identification.

Workshop six, The Importance of Vaccines for Health and Well-being (Immunology Area) began with reports of experiences on the subject. Then, a discussion was raised about the previous knowledge of the use of vaccines in their personal experiences. Subsequently, through audiovisual resources, a journey through the history of vaccination was carried out, demonstrating the prophylactic importance in the prevention of epidemics and infection control. In order to perceptively probe the reach of the content, the questioning about the relevance of vaccines was resumed by personal testimonies.

At the end of the last workshop, the participating students were invited to answer a satisfaction questionnaire (Appendix 1) that presented questions such as: "How old are you?", "Is this the first time you visit UEFS?", "Would you like

to return to UEFS to participate in new workshops?", "Of the workshops you attended, which one did you like the most?". plus open space to describe your impressions/suggestions.

The qualitative evaluation of participation, adherence, and development of awakening to various interfaces of the sciences was carried out in the same questionnaire using a Likert scale10 in which the respondents indicate their degree of agreement or disagreement (do not totally agree: -2, do not partially agree: -1, neutral/indifferent: 0, partially agree: 1, strongly agree: 2) with the statements related to a given topic. The following questions were asked: "I believe this activity is interesting"; "Playful activities help in learning"; "I would like to bring friends to visit these workshops"; "This activity was important for my knowledge and learning"; "The content becomes easier to understand when viewed outside of books."

The analysis of the collected data was carried out based on the interpretations obtained in the answers to the questionnaires answered at the end of the third workshop offered. To demonstrate the results expressed, tables and graphs representing absolute numbers or percentages were used using Word and Excel (Microsoft) programs.

Results and Discussion

A total of 80 students participated in at least three multi-thematic workshops prepared by professors from the State University of Feira de Santana – UEFS and monitors from NUPEECBio, aiming to associate theoretical knowledge with their daily experiences, of which 97.5% filled out the satisfaction questionnaire. The vast majority of the participating students were between 12 and 14 years old.

As Morin and Diaz (2016)[11] explain, the University has been assuming new roles in the twenty-first century, extending to society through academic and extension actions, with an emphasis on public policies, which encourage the co-participation of the community in its educational formation. In this regard, the University can be the ideal setting for educational interventions in the elementary school grades as long as there is a didactic planning based on the social reality and on the engagement of the faculty to the student realities.

Multi-thematic interactive workshops were held to provide reproducibility in their respective social environments, in accordance with the proposals of the Ministry of Science, Technology and Innovation, by bringing the science developed in academic environments closer to society. Our results indicate that the vast majority of students liked the activities carried out by the externalized perceptions in a final dialogue circle. These workshops proposed to stimulate skills and competencies by placing students as autonomous learners in the construction of knowledge.

The distribution between the preference of the workshops varied greatly and most of the classifications marked on the Likert scale (-2, -1, 0, 1, 2) for the statements presented were in the maximum score (2). According to the testimonies, the students stated that they had no previous knowledge about some of the proposed themes. In the general context, all actions received good evaluation by the students (Figure 1).

It was evidenced, with about 70% of satisfactory opinion, that the exposition of the theoretical contents, when associated with practical activities, generates in them a significant greater importance in relation to the subjects, expanding the cognitive apprehension. Studies by Santos et al, (2020)[9] and Granjeiro (2016)[6], report that the association between theory and practical/ludic activities obtains greater significance among students, as they make them experience their realities, stimulating the subject to be reflective and active in the teaching/learning experience. These data corroborate our results in the present work, where we associate the theories of the workshops with applications to everyday realities.

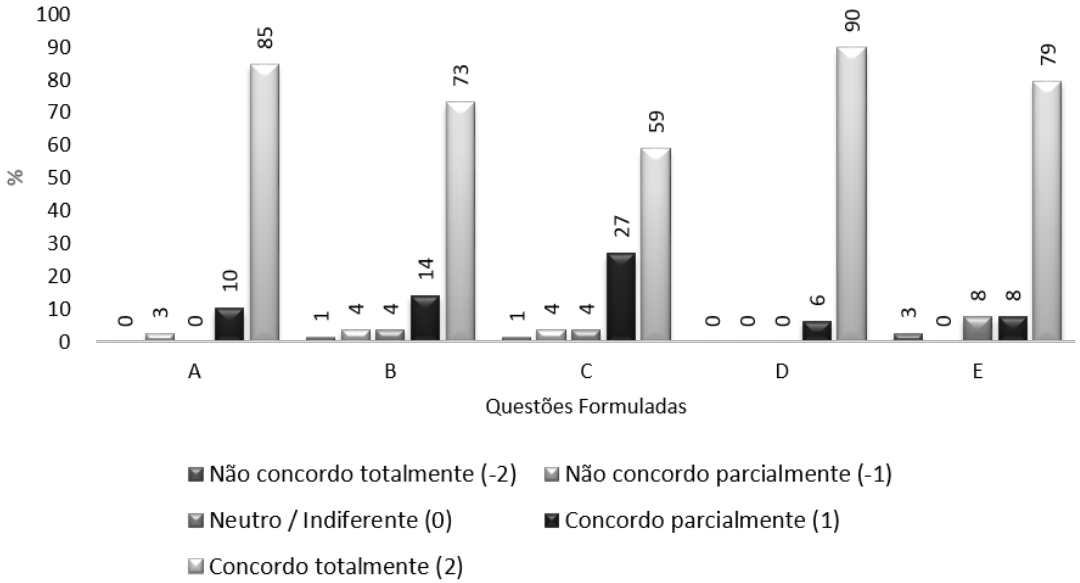

Figure 1. Graph representing the percentage of opinion referring to the degree of satisfaction perceived by the responding students (n=80) on a Likert scale (Araújo et al., 2015), in relation to the following questions: A. "I believe this activity is interesting". B. "Playful activities help with learning." C. "I would like to bring friends to visit these workshops." D. "This activity was important for my knowledge and learning." E. "Content becomes easier to understand when viewed outside of books."

Regarding the students' answers to the open questions, they included words such as learning with fun, experiencing phenomena and interacting with knowledge. These statements corroborate the need to develop socio-emotional and effective skills, which are translated into collaboration, cooperation, creativity and criticality.[12]

It was expressed in the dialogues the desire to participate in workshops in other areas of knowledge such as: physical education, astronomy and arts. It is worth mentioning that many answers were of the type I want to "learn and study about everything". In general, the students stated that they intend to learn "MORE" about certain subjects in areas of their preference; Some revealed their desire to join one of the courses offered by the institution.

In view of this, we encourage that formal education only develops through theoretical/practical interrelations that should not be limited only to the contents developed in the school environment. It is known from the expositions of educational thinkers such as Freire (2019)[13] and Palangana (2015)[14] that cognitive development is established and based on multiple relationships and strategies that aim to associate school student experiences with their experience in the

social environment. It was from this perspective that we thought of associating the contents developed by the teachers in their pedagogical practices to the workshops, as these would seek to present the importance of the practical application of the contents seen in the basic education of these students. This planning proved to be successful due to the degree of satisfaction shown in Figure 1.

From the teachers' perception, these experiences were able to provoke the effectiveness of the development of knowledge by virtue of planning based on teaching competencies structured in theoretical. According to Anastasiou and Alves (2007)[15], teaching competence is developed from planning to the selection of actions for didactic interventions. Hence the importance of teachers' choices of these actions to be carried out under their supervision aiming at the intended objectives, that is, apprehension and construction of significant knowledge. According to Gomes et al (2007)[16], in the words of Ausubel, "Meaningful Learning is based on information, ideas and propositions that acquire meaning for the learner through relevant anchorages in the individual's pre-existing cognitive structure".

Seeking to problematize the contents proposed by our group, we developed a systematic approach that would connect to a better reach of the contents. Thus, the workshops were designed as an instrument of pedagogical support as a strategy to enhance cognitive development, in addition to establishing connections between them that favor learning. This was evidenced by the statements extracted from the students after each workshop. It should be considered that the different workshops provided a gain in content to the students, as they offered multiple stimuli that were consistent with the significant introjection of knowledge.

It was from the perspective of promoting a dynamic and challenging learning process that we stimulated a cognitive reconstruction of previous knowledge. By the degree of motivation expressed in loco and by the interpretation of the data of the scale (Figure 1) and satisfaction questionnaire (Appendix 1), we noticed that during the actions carried out, the students were challenged to mobilize knowledge and develop cognitive, procedural, integrative, organizational and socio-affective skills.

In the Human Anatomy and Genetics and Molecular Biology workshops (Figures 2C and D), curiosity was awakened and knowledge about the genetic material and organs of the human body were redefined by the multimodal experiences lived by the students, demonstrating the effectiveness of the association between theory and practice in the construction of knowledge. The various active methodologies used in these workshops provided the students' protagonism in the learning of the proposed contents, and may have even generated sensitive skills.

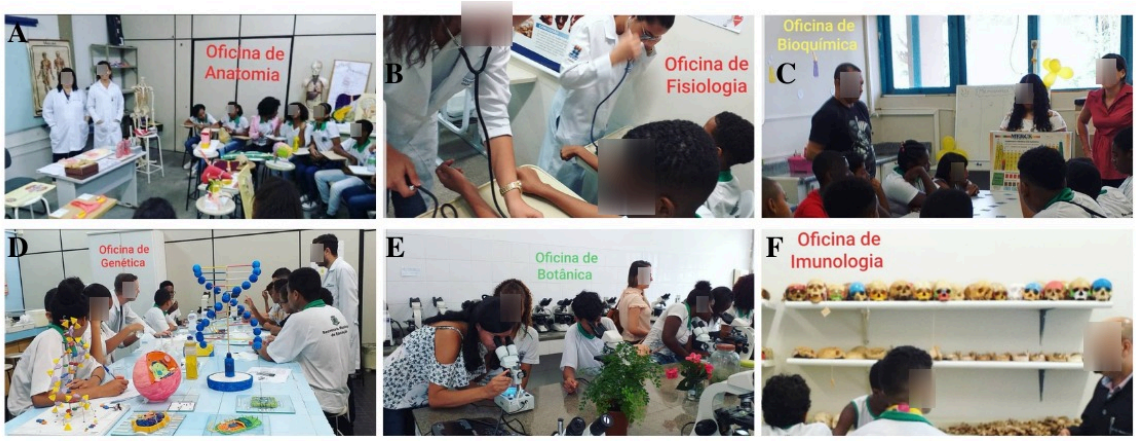

Figure 2. Illustrative images of the activities carried out by NUPEECBio and UEFS Didactic Laboratories, SNCT 2019. A: Journey to the Human Body (Anatomy Workshop); B: Why is High Blood Pressure Harmful to Health? (Physiology Workshop); C: Unraveling the role of chemical elements in the human body and the environment (Biochemistry Workshop); D: Playing Geneticist: discovering DNA (Genetics and Molecular Biology Workshop); E: Getting to Know Plants: Diversity and Importance (Botany Workshop); F: The importance of vaccines for health and well-being (Immunology Workshop) (Feira de Santana, Bahia, 2019).

These workshops were the ones that showed the highest degree of satisfaction with the students' reports. Certainly, the synesthetic association experienced in the anatomy workshop, as well as the practical activity performed by them in the genetics and molecular biology workshop, explain these findings.

Conclusion

This experience allowed us to make a reading of how an interdisciplinary collaborative work developed at the University can dialogue with elementary schools. The interactive workshops allowed practical applicability of various knowledge in the field of science, taking advantage of the life experiences brought by the students. Encouraged to participate by the teachers responsible for each workshop, they were able to be protagonists of their learning through observations, reflections and questions about the subjects addressed.

We attribute this success to the application of a teaching approach based on a horizontal dialogic relationship between all those involved in the teaching-learning process within the workshops. Undoubtedly, this form of teacher-student interaction allows the construction of a sense of belonging to the group, leaving the student free to explore their curiosity and logical reasoning. These exchanges of experiences also benefit teachers, since pedagogical praxis must be constantly reassessed and innovated.

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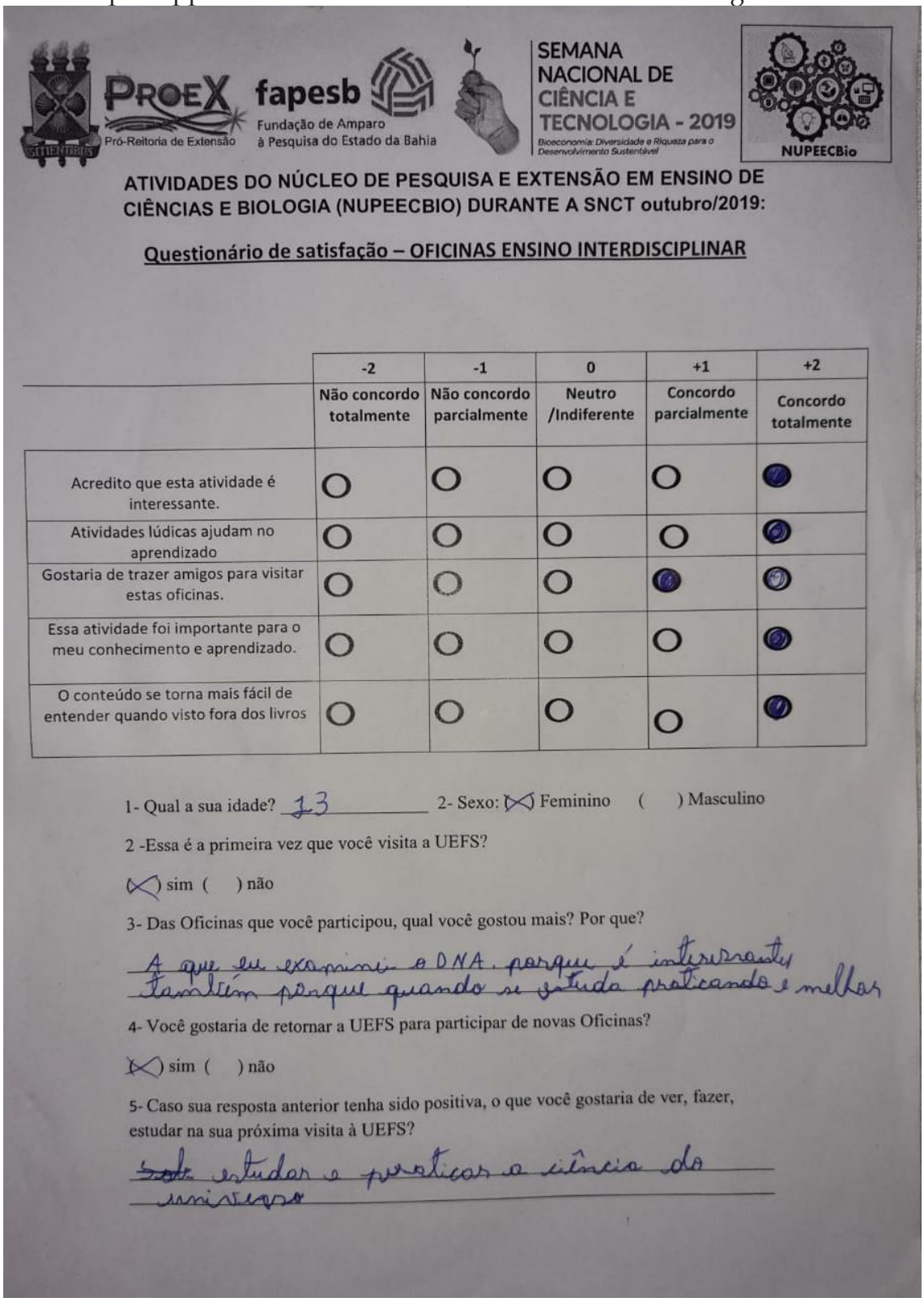
Appendix 1. Satisfaction questionnaire of the Interdisciplinary Teaching Workshops applied to Basic Education students during SNCT 2019.



PROEX Pró-Reitoria de Extensão — fapesb Fundação de Amparo à Pesquisa do Estado da Bahia — SEMANA NACIONAL DE CIÊNCIA E TECNOLOGIA - 2019 — Bioeconomia: Diversidade e Riqueza para o Desenvolvimento Sustentável — NUPEECBio

ATIVIDADES DO NÚCLEO DE PESQUISA E EXTENSÃO EM ENSINO DE CIÊNCIAS E BIOLOGIA (NUPEECBIO) DURANTE A SNCT outubro/2019:

Questionário de satisfação – OFICINAS ENSINO INTERDISCIPLINAR

	-2 Não concordo totalmente	-1 Não concordo parcialmente	0 Neutro /Indiferente	+1 Concordo parcialmente	+2 Concordo totalmente
Acredito que esta atividade é interessante.	○	○	○	○	●
Atividades lúdicas ajudam no aprendizado	○	○	○	○	●
Gostaria de trazer amigos para visitar estas oficinas.	○	○	○	●	●
Essa atividade foi importante para o meu conhecimento e aprendizado.	○	○	○	○	●
O conteúdo se torna mais fácil de entender quando visto fora dos livros	○	○	○	○	●

1- Qual a sua idade? 13 2- Sexo: ⊠ Feminino ( ) Masculino

2 -Essa é a primeira vez que você visita a UEFS?

⊠ sim ( ) não

3- Das Oficinas que você participou, qual você gostou mais? Por que?

A que eu examinei o DNA, porque é interessante também porque quando se estuda praticando é melhor

4- Você gostaria de retornar a UEFS para participar de novas Oficinas?

⊠ sim ( ) não

5- Caso sua resposta anterior tenha sido positiva, o que você gostaria de ver, fazer, estudar na sua próxima visita à UEFS?

Sobre estudar e praticar a ciência do universo