

## TEACHING TEENAGERS ABOUT THE IMPORTANCE OF CENSUS DATA BY ACTUALLY CONDUCTING ONE IN THEIR SCHOOL: A COLLABORATIVE LEARNER-CENTERED APPROACH

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*Census data offer opportunities for every citizen to access rights and collaborate in a democratic society. Developing statistical literacy starting at school age can be a determinant for future critical citizenship as well as for future cooperation in responding to Census and other surveys. At the Brazilian Institute of Geography and Statistics (IBGE), there is a National School of Statistical Sciences (ENCE). This paper is about an experience ENCE conducted with 12 to 13-year-old teenagers from a public school of Rio de Janeiro, Brazil, to design a census operation in their schools. The experience included an open doors event as a preparation for the census and some follow-up visiting rounds in the school to assist with the stages of the census operation itself, ending with the presentation of results in ENCE premises. The project was the result of the collaboration between IBGE's official statisticians, ENCE statistics educators, ENCE undergraduate students and the public school teachers and teenagers. The teenagers were actively engaging in activities, protagonists of their learning experience, and willing to talk about the experience to their families, showing meaningful learning and empowerment.*

### INTRODUCTION

Teaching statistics at school age can pose challenges, considering learning experiences in this matter are usually abstract and disconnected from a direct application to students' lives. In Brazil, statistics is part of national curriculum, but associated directly with the discipline of Mathematics, which tends to reduce this knowledge to calculus activities. Therefore, making pedagogic choices to introduce students to statistics in a meaningful way is critical to develop interest in data and skills for life. A humanistic pedagogy is particularly suitable as it proposes learner protagonism, real life application, critical stance development, and collaborative learning. Those contributions naturally dialogue with what is required to promote statistical literacy.

Apart from the difficulties in finding a consensus about the definition of statistical literacy (Sharma, 2017), a basis of values is important for one interested in educating for citizenship – or for individuals to “engage with social issues” (Ridgeway et al., 2018, p. 3). That basis includes critical thinking, contextual understanding, and actual use (a sort of transfer) of statistical knowledge in position-taking and decision-making processes. In this sense, there is a shift in perspective about literate individuals as they should be treated not as passive proficient consumers of data, but rather active users and even potential producers of data. This way, settings that promote statistical literacy would be pervasive to the contemporary data dynamics, from collection, to storage, and eventually representation (Gould, 2017). Gould (2017) advocated for the idea that learners should experience “the dual role of statistical producer and consumer” (p. 22).

An educational foundation that suits such an enterprise is the humanistic view (Freire, 2005). In this view, learners are valued as protagonists of their own learning; they are not passive receivers of a body of knowledge teachers transfer. “Learner-centred approaches change the role of an educator to one of being a facilitator of learning processes” (UNESCO, 2017, p. 55). They bring previous knowledge and experiences to the process of learning, as well as previous beliefs and dispositions (see Ridgeway et al., 2018 for a discussion of disposition in statistical literacy). Further, learners actively perceive the world, question the status quo, and engage in open dialogue and collective reflection to transform power relations (Freire, 2005). In this sense, local needs and knowledge are key to transformation and human development.

In this article, a local statistical literacy experience with a public school of Rio de Janeiro shows the potentialities of a humanistic educational approach by considering learners in the center of their own process of learning. The experience was learner-centered in some aspects: i) they were the designers of the Census questionnaire; ii) they were the enumerators, and iii) they were responsible for

the presentation of the results. By completing the whole cycle of an investigative project, they were protagonists of their own learning.

The use of a project-based pedagogy, and other active methodologies, was recommended by the National Common Curriculum Base (BNCC) in Brazil as one way to promote learning centeredness (Brasil, 2019). A project of this kind helps develop statistical thinking competency, but it also develops socioemotional competencies, such as collaborative work, curiosity, autonomy, and creativity (Lima & Giordano, 2021). If the project includes real data connected to the daily life of students, learning is even more empowering (Lima & Giordano, 2021)

The purpose of this paper is to report a learning experience in a public school of Rio de Janeiro conducted by the National School of Statistical Sciences (ENCE) to assist teenagers in conducting a Census in their school. As the project had started before ENCE's intervening action (they had already decided theme and target population), the authors of this paper engaged in the project willing to know how to make experience of learning meaningful in all the subsequent phases of the investigative cycle. In this sense, pedagogic choices and partnerships inside IBGE to support the learning experience will be discussed as contributions to humanistic learning projects involving statistical literacy.

## THE EXPERIENCE

In 2023, the National School of Statistical Sciences (ENCE) started an extension project involving undergraduates entitled "Statistical Education: statistics as an ally in the development of critical thinking". The purpose of the project was to promote statistical literacy for schools by opening the doors of ENCE to receive teenagers in ludic and engaging activities involving statistics. In May, 160 teenagers visited ENCE and listened to a lecture about statistics and the statistics graduation course. Following that, they experienced a hands-on experience to make decisions (including whether information was fact or fake) based on evidence (statistical data in graphs and tables in a set of printed handouts). The teenagers were 12 to 13 years of age and came from a public school in front of ENCE. They were all teenagers from low-income families. The event was so successful for the school that its director called the ENCE professors four months later to assist with a census project they were planning with the same teenagers. They were inspired by the official Census IBGE was running in 2023, and decided to run their own census. They defined the target population as teenagers from late middle school (corresponding to 12 to 15 year-old teenagers), and they decided to develop a questionnaire to find out the respondents' socio-economic profile and level of satisfaction with the school services.

ENCE's action to assist with the census at the public school was split in two movements: a new open doors event as preparation for the census and follow-on visiting rounds in the public school during the census operation itself. The extension project involved six ENCE undergraduates, three ENCE professors (two of statistics and one of education), one specialist from the Census Department of IBGE, two teachers from the public school, and one specialist from the Dissemination Department of IBGE (coordinator of the IBGEduca project, IBGE's educational portal, <https://educa.ibge.gov.br/>). Everyone in the project participated in the conception of the action. Some meetings were held to discuss what experiences would be offered to the school teenagers to help them develop a census at their school.

Undergraduates were actively involved in preparing informative and instructional material to be exposed and explored at the event in ENCE's premises. Material included slides on the importance of surveys, a brief history of the Census, the purpose of the Census and the IBGE Census operation. They used subjects very close to the teenagers' reality, and interests such as dating dilemmas, popular snacks, or video games. Advised by ENCE professors to use a plain language and storytelling to facilitate understanding of abstract concepts, they used Artificial intelligence to generate images for the history of Census and to create a fictional family to show how census information impacted their lives as to the provision of public services in education, health care and transportation (See images in Figure 1).

In addition, for the hands-on sessions, material (including slides and handouts) was developed to facilitate questionnaire design. Teenagers were invited to experiment with different types of questions (open-ended and closed questions) and design a mock questionnaire for a specific context involving decision-making. They could also reflect on biased questions and confidentiality along the survey design process. The undergraduates were the facilitators of those practical sessions as well as the presenters in the general initial lecture. The specialists from IBGE also lectured in the plenary moment, bringing the real experience of IBGE in conducting the Census and in disseminating results. Slides

included a presentation of IBGE and how Brazilian citizens use IBGE data for different purposes. It also showed Census stages and curious happenings during Census operation. Finally, it brought a reflection on the importance of information about population for policy-making.



Figure 1. Images created using Artificial Intelligence for presentations about Census: The left image illustrates the history of census, and the right image shows a fictional family being impacted by Census data.

Before the follow-up visits, in November of 2023, eight teenagers from the public school went to the premises of ENCE to present a poster (see Figure 2) about the objectives and four steps of the project: 1) visit to ENCE’s premises, 2) production and testing, 3) census survey application, and 4) analysis and data dissemination. The poster also included the names and photos of the school advising teachers and the four class groups involved in the project. They presented their work to undergraduates and professors of ENCE in the traditional ENCE seminar of scientific initiation (see Figure 3).



Figure 2. Teenagers’ poster on the process of conducting a census in their school. The poster was presented by the teenagers from the public school in ENCE’s Seminar of Scientific Initiation.



Figure 3. Undergraduates aiding teenagers. This photo shows one of the moments undergraduates helped teenagers from the public school to analyze the census data they produced.

The teenagers also distributed flyers containing images of the project stages, showing teenagers elaborating, testing (with 10 teenagers), and applying the questionnaire.

In the follow-up visits to the school, ENCE professors helped analyze the database produced by the teenagers and facilitated some sessions to help them transform tabulations into graphs. Teenagers could learn about the different types of variables, the different types of graphs, and the use of google sheet to create graphs. They were also invited to do some analysis considering the results they found, including the more difficult task of crossing more than one categorical variable for analyses, e.g. an analysis of the level of satisfaction with teachers per study shift (morning, afternoon, or evening). Undergraduates were key in helping school teenagers with doubts and help facilitate debates, such as how to analyze data, which theme to be made public and how they could use data to change school policies. The latter was particularly heated.

## IMPLICATIONS

In terms of didactic experience regarding the instructional and informative material developed for the learning activities, experience showed using a type of language closer to the reality of the teenagers was engaging and motivating, especially considering their reality and popular content for them, such as video games and celebrities they like. They were able to interact with undergraduates in the flow of the activities and understand complex themes, such as what to consider in choosing a type of survey (sample or census) and the purpose of a census. Undergraduates' participation was key because they are proximal to the teenagers' reality and ended up being a role model for the teenagers, as they mirror their immediate future. Teenagers were very receptive and engaged when undergraduates helped them do the exercises and conceive their census project (see Figure 3).

Considering a learner-centred and project-based pedagogy, some implications seem to derive from this experience. Teenagers were able to develop socioemotional competencies (Linda & Giordano, 2021) enabled in the several stages of the project, going beyond the development of competencies more connected to statistics and cognitive processes involved in an inquiry process.

- Collaborative work: every phase was done in groups. There was a test with ten teenagers and even poster presentations were collective, with eight teenagers chosen to participate in the enterprise. The enumeration phase was especially challenging and required group work.
- Curiosity: as teenagers themselves conceived the questions for the census, they were invited to associate their curiosity with the statistical enquiry process. In this sense, the process of discovery was based on evidence, as they generated data to answer their interest questions.
- Protagonism: the sense of responsibility was present through the whole experience as they were the actual data producers, favoring the potential of a meaningful literacy process, in which students live the dual role of data producers and consumers, as Gould (2017) advocates (See Introduction).
- Creativity: that was a special competency necessary to overcome the challenge of refusal in responding to the Census. Teenagers were caught by the need to convince their peers about the importance of responding to the Census.
- Social engagement: in the debates of how their census results could impact school policies, teenagers were able to connect the process of enquiry to an actual application. They experienced an ideal process of decision making, anchored by evidence. Discussions at this point were alive, showing the potential of projects with a direct local application for a meaningful learning experience (Brasil, 2019; Gould, 2017; Ridgeway et al., 2018) and for an empowering development of the individual as fully capable of questioning status quo (Freire, 2005).

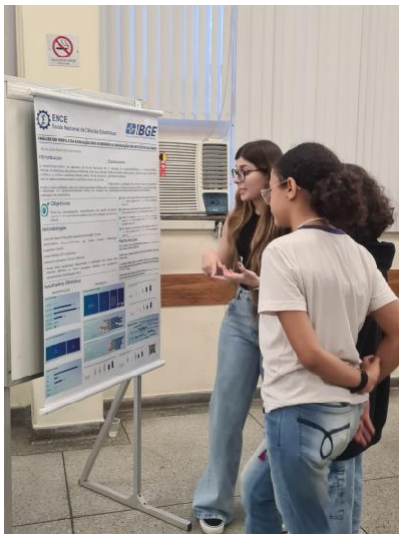
The project also showed impacts on beliefs (a type of disposition involved in the process of statistical literacy, see Ridgeway et al., 2018). By facing difficulties in getting responses from peers, the teenagers spontaneously advocated for the importance of responding to Census. Some of them made comments mentioning they received IBGE enumerators at home and responded to Census. Others shared conversations they had with their parents about the project at school and its association to the IBGE Census. That kind of observation besides being important to the literacy process itself is



especially critical to prepare the future respondents of surveys those teenagers will become – citizens fully aware of their role in contributing to the generation of information about their country.

The direct participation of IBGE Census and dissemination specialists in the experience seemed to contribute to those associations the teenagers mentioned. As they heard from specialists about the challenges of collecting data, they connected more easily when they themselves faced difficulties in getting responses or even when designing the survey. At this point, experiences of that kind developed in a partnership between the National Statistical Institute (NSI) and the academia/school seem to be more fruitful. The challenge to scale up the participation of an NSI in that type of work remains. Possibly, using the educational portal of IBGE, IBGEduca (<https://educa.ibge.gov.br/>), to reach schools more widely with lesson support material associated with the dissemination of IBGE' work can be an alternative.

Another interesting result was the apparent empowerment of these teenagers in the whole experience, but particularly noticed when they presented the census they built and executed at ENCE's Seminar of Scientific Initiation. This is a formal event for undergraduates to present their first scientific incursions. It was the first time teenagers "shared the stage" with university undergraduates. They showed pride and engagement and made statements that evidenced how the experience was meaningful to them. They felt comfortable not only presenting their work, but also visiting undergraduates' work and asking questions (See Figure 4). They also presented very well to ENCE teachers (see Figure 5).



*Figure 4. Visiting undergraduates' posters. This photo shows one of the moments teenagers from the public school visited an undergraduate's poster and asked for explanation.*



*Figure 5. Poster presentation in the Seminar of Scientific Initiation. Teenagers from the public school presenting the poster to an ENCE's professor and explaining the folder.*

## CONCLUSION

A humanistic approach, considering learners as the center of the learning experience and as individuals capable of monitoring social power relations, is a natural match to a view of statistical literacy as a process that prepares for the full exercise of citizenship. A project-based approach to plan and implement a census survey in schools seems to be particularly prolific in developing socioemotional competencies in addition to the cognitive statistical competencies involved in that sort of enterprise. Additionally, as students experience the role of data producers, their beliefs towards responding to official surveys are reviewed, favoring a more conscientious view of those activities and their roles.

In this context, partnerships between NSIs, academia, and schools can show interesting impacts on the education of young students, as well as on the influence they can make on their families or close relations, suggesting a propagating effect. The connections of official statistics to local inquiry projects help understand the laws that underline efficient and democratic decision-making, applying to the microcosm of a school or to the macrocosm of a country.

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