

## CREATIVE INSUBORDINATION AND THE ARGUMENTATIVE PROCESS IN STATISTICAL EDUCATION IN EARLY CHILDHOOD

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*The purpose of this paper is to reveal the creative insubordination of students regarding activities proposed by the teacher, by means of argumentation, expressed in Statistics activities. To do so, we posed the following question: While learning mathematics and statistics, how do students become creatively insubordinate regarding the activities proposed and argue in favor of their own interests? To answer this question, we collected data from the children's oral and written narratives. The investigation of narratives is taken not only as methodology but as a means of constructing reality, as this methodology is anchored on ontology. It becomes clear that the argumentative process arising from the analysis of the data increases the children's self-confidence and autonomy, as well as enables the appropriation of statistical skills.*

### INTRODUCTION

In this article, we will discuss evidence of creative insubordination, brought about by argumentation, during the process of learning statistics. Argumentation is characterized as a critical discussion during which points of view are constructed, negotiated and transformed.

According to Chiaro, Leitão (2005) argumentation has a unique potential, different from other types of discourse, which stimulates the participants to review their perspectives regarding the physical or social world.

Placing students at the center of the educational process, challenging them to identify problems and propose solutions are acts of creative insubordination in face of a passive attitude during learning. The child takes a stand according to their interests and those of the group in which they are inserted to question and discuss situations that present themselves in their study context.

In this research, oral and written narratives of children aged 6 to 7 years were analyzed while they were analyzing statistical data constructed from problems proposed by the teacher. According to Lopes (2008), the acquisition of statistical knowledge can help individuals in the analysis of data, from problematization of information, enabling them to understand their reality while immersed in complex contexts. This allows students to make predictions and decisions.

### WORKING WITH CLASS PROJECTS

In this teaching and learning process, which employs Class Projects as methodology, the teacher is no longer a mere transmitter of knowledge and becomes a researcher, working together with their students. This methodology seeks to develop knowledge from the investigation of a real-world problem, by considering the context, and acting cooperatively in search of solutions, and confronting the different points of view of the individuals involved. This way, the knowledge acquired is not considered as finished, but as something resulting from a dynamic process, in which the answers bring about other questions, and most of the time, a single answer or a single point of view is not enough.

Working with their students, listening to them and heeding what they think, suggest, and how they feel, can be observed as evidence of creative insubordination on the part of the teacher, who fosters their students' argumentation skills, so that they become independent and confident individuals. Lopes & Mendonça (2017) claim that although some might view this practice of class projects differently, there is a consensus that this form of pedagogical action can promote teaching and learning, creating cooperative environments in which students are active, autonomous and conscious of their responsibility in the construction of their own knowledge.

The present work was conducted in a private school, in the interior of the State of São Paulo, and had the participation of children attending the 2<sup>nd</sup> year of Primary school (7 to 8 years of age). In this school setting, the theme to be developed is chosen by the pedagogical team, and it is derived

from an issue or problem addressed in the Universal Declaration of Human Rights; and in this case the theme Rights of Elderly Citizens was chosen.

Topics related to the daily life of the community, people's lives, their needs and interests are chosen, and the age range of the children is also taken into account. After a discussion and effective participation of the students, considering the interest of the class as a group, the teacher prepares the activities. In addition, the coordinators of the course and of each area of field related to the activity developed provide extra support. The theme of this Class Project was the childhood of grandparents and great-grandparents and how they live at present.

This context shows the experiences and relationships of the children with their grandparents and great-grandparents. As a result, the children have the opportunity to broaden their social relations at school, which until then were restricted to the family. They can also establish relationships with elderly people in the community where they live, in a respectful manner, thus acting as citizens themselves.

During this Class Project, the children were faced with differences and similarities among the different epochs, and establish relations within the theme, based on accounts of some elderly citizens, observation of antique objects, in comparison to modern objects, photographs, images, field work, as well as other teaching activities, in order to discuss, understand and form opinions regarding the reality in which their grandparents and great-grandparents live.

Among several activities, the present work will discuss an interview conducted as a strategy for addressing questions which were elaborated according to the interests of the group: Are elderly people respected nowadays? Why? How can we care for an elderly person so that they are happy and healthy?

Based on interviews, with real data, the children collected and organized such data, and interpreted the resulting information in light of the context and sample at hand.

According to Lopes (2012, p.165),

The experience of collecting, representing and analyzing data that are meaningful and contextualized can broaden the universe of competences and accentuate children's creative potential. Children have the right to learn to analyze, through their perspective, the situations that they experience and to assign values derived from their perceptions, and it is up to adults to present considerations so that children can acquire an ethical background marked by autonomy and authority.

## ORGANIZING THE DATA COLLECTED

In the present work, we will analyze only the data regarding the age of the participants interviewed. The question was how to organize the data collected regarding the ages of interviewees. This was an issue that worried the teacher; as organizing age means working with numerical intervals which had never been attempted with this class before.

In this type of activity, the teacher has to be prepared to deal with uncertainty, and to test their ability to recognize the moment to intervene and the moment to listen to the students. The circumstances do not always favor a good progress of the lesson, but the effective participation of the students and the confidence that the teacher puts in them makes the classroom environment pleasant and moments of failure result in learning.

Below, is the transcription of the moment in which the teacher begins questioning how to organize the data regarding the age of grandparents and great-grandparents who took part in the survey.

*Researcher: How can we organize these data, starting with the ages.*

*Carla.: The ladies and gentlemen who are the same age for one group, and the ones with different ages in another.*

*Researcher: Máira what is your doubt? (the student had raised her hand)*

*Máira: So, this way, many grandparents may be different ages, then we will have many groups with very few people!*

*Researcher: And what should we do then?*

*Rafaela: We could include different ages in one group.  
(excerpt)*

*Researcher: Ages that are close will be in the same group! (some students ask to speak) Ok, I will hear everyone! Bruno, you may start!*

*Bruno: We could create a group like, for example, every ten years... One grandmother is 65, the other 63 and the other 64, all in the same group, ranging from 60 a 70. So, we can have groups for 10 years.*

*Researcher: Anyone else?... (Carla raises her hand) Go ahead, Carla!*

*Carla.: Mine is similar to Felipe's, but...*

*Teacher: go ahead...*

*Carla.: Like, suppose that like you "support", starting at 54, the people between 54 and 59, are in one group, and the people who are 60 to 69 in another.*

*Researcher: Anyone else? Go ahead, Lúcia. (the student had raised her hand)*

*Lúcia: It is practically the same as Carla, but it is.....include, for example, those who are 70 something, in one group, those who are over 60 in another.*

In the dialogue above we can observe how important the group was to promote the exchange of ideas and discoveries among peers. When Carla says she has a question, the group tries to think of a solution for very small groups. Bruno suggests the solution of organizing intervals of ten years, and I was surprised that, Máira said that her suggestion was similar to Bruno's, but the only difference is that the ages would not be repeated, because she suggested an interval of 60 to 69. The fact that some students agree with what Bruno had said, and express themselves orally through a similar explanation demonstrates that the children understood what was suggested and managed to establish relationships with what was presented.

Then, the Researcher organized the students in groups of 10 and proposed that they created a record which included all grandparents' ages according to the intervals which had previously been agreed on. Each group received a piece of paper to create such record as they saw fit, provided that they could explain the resulting record.

Below we will discuss the records created by one of the groups.

The group began by writing the number 60 and at a certain distance the number 69. After that, they recorded the ages which were within the interval.

When it came to registering 75, the group was unsure where to put it, as they were certain that it was not in the 60 to 69 range. Then, Felipe suggested that the numbers 70 and 79 be written below and they wrote 75 right in the middle. After that, the number 71 appeared, which was easy to place before 75.

When a member of the group said that they also had the ages 58 and 59, the student responsible for writing the record, immediately and without hesitation wrote 50 and 59 on the upper portion of the paper. The group found it easy to include 58, but 59 was a problem, as it is both the age of one of the elderly citizens and the limit of the interval.

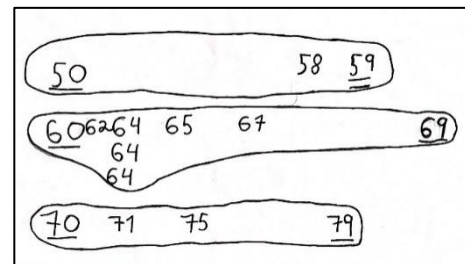


Figure 1: Group record

After all the ages had been collated, the group continued:

*Student: Do it like that... (runs his finger around the groups and tells the colleague to circle the different groups: 50, 60 and 70.)*

*Researcher: Do you have everyone's ages?  
(and Pedro is still circling the groups)*

*Researcher: Now, I'd like to understand something: 50, 60 and 70 are real ages, or are they for...*

*Bruno: No, it is just to divide!*

*Pedro: Except for this one. (points at 59)*

*Bruno: Yeah, except for this one!*

*Researcher: Oh, so, how do I know this one is the actual age and this one is the limit?*

*Pedro: You can make a little line, like that! (shows a vertical line from bottom to top next to the number). Some agree, including me.*

*Bruno: make a line at the bottom to show the limit (Pedro starts drawing a line under 70, 60 and 50).*

*Researcher: Ah, the limit, ok! On the other side...*

*Many speak at the same time: This is the age! (pointing to 59)*

*Researcher: And, is it the limit?*

*Bruno: It is both age and limit!*

*Researcher: How do you intend to represent both age and limit?*

*Carla.: Put two lines underneath!*

After the record was concluded, the Researcher asked the members of the group which numbers represent ages. They promptly identified the numbers and agreed to underline them.

However, there is a problem: What about number 59? Without any hesitation, the children explain that it represents simultaneously an age and a limit. What now? Carla, rather casually suggests that two lines should be drawn under the number 59, thus representing both age and limit.

According to Lopes (2011), the interaction among students, and between the students and the teacher is essential in the teaching and learning process, both for Mathematics and Statistics. The dialogue about the knowledge, through which obstacles, difficulties and dilemmas are discussed, effecting consensus which results in the collective production of knowledge.

In another occasion, the Researcher displayed on the board three records and posed the following question: Do these three records represent the total number of grandparents for the whole class?

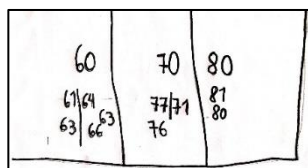


Figure 3: Group record

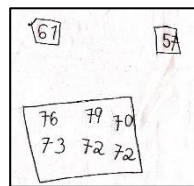


Figure 2: Group record

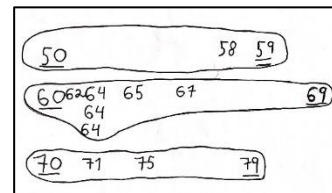


Figure 4: Group record

The majority of students agreed that the records did not represent the total number of grandparents for the whole class, and one student explained:

*João: It is because it is a group, so you will only get the data from your group.*

*Researcher: How many students does each record represent?*

*Students: 10 students!*

*Researcher: How can we put together all these numbers, in order to have the total number of interviewees for the whole class?*

*Ricardo: Stick them together with (masking) tape!*

*Beatriz: You can copy all the numbers in one large sheet of paper!*

The students could not obtain the sum of frequencies, so the teacher read all the records on the blackboard. That way they began to see the total number of elderly people. Some students went to the blackboard and, with the help of the teacher, they prepared the record shown herein. The circled numbers represent the number of elderly people who participated in the survey.

At a later stage, the Researcher put the record back up on the board, recapitulated what they had previously done, and asked the following question: Would anyone who came to the school and just looked at this record know what these numbers mean? The children were surprised by the question, and the Researcher invited an adult to come to the class, and asked if he knew what the record meant. The students had to provide clues to the person, so that they understood the meaning of the numbers.

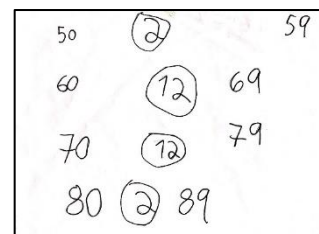


Figure 5: class group record

After that, the children were organized into 3 groups of 10 students with the purpose of making a record whose meaning anyone could grasp. The Researcher made it clear they could use numbers, words, a ruler, whatever they wanted. The records prepared by the groups were as follows:

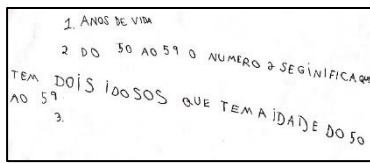


Figure 8: Group record

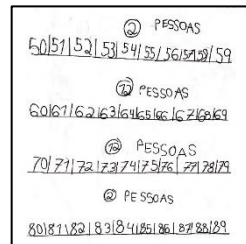


Figure 6: Group record

idade das avós e bisavós	A	idade das avós e bisavós	quantidade das avós e bisavós
50	A	59	2
60	A	69	12
70	A	79	12
80	A	89	2

Figure 7: Group record

The members of the group who drew figure 6 could not finish the record because, as they explained, “it was very time consuming”. To understand the meaning of the numbers in figure 7 the class needed help. After a vote, the representation shown in figure 8 was chosen as the one which showed more clearly the total number of elderly people who participated in the survey. The students could not get to the name "table", without clues provided by the teacher.

CONCLUSION

The observation of the activities developed show that small children (7 to 8 years of age) are capable of collecting, representing and analyzing data. Therefore, it is essential to offer children the possibility to investigate, represent and analyze data that are meaningful to them; within their context.

The theme “At the time of our Grandparents and Great-grandparents” deals with a reality which is close and affective for children, as well as shows the importance of respecting and valuing elderly citizens in our society. It makes a lot of sense for the children to work with the ages of their grandparents and great-grandparents. In statistics, numbers are seen in a context, which is the basis for the interpretation of the data.

The challenge proposed during the discussions has shown evidence of creative insubordination, when some of the children do not readily submit to any idea. They reflect on what has been said and clearly enunciate their doubts, arguing, and proposing solutions for the problem at hand.

Another aspect to be considered is the evaluation of the records created by the children. According to Lopes (2012 p.167),

The key to statistical problems is that by their very nature, they have no single solution, and such solutions cannot be deemed as totally wrong or right - they must be assessed in terms of the quality of the reasoning, the appropriateness of the methods used in relation to the nature of the existing data.

The solutions presented in the activities described show that there is no single solution. In the analyzes proposed, all solutions were correct, but not all explicitly showed the reasoning used, which made it difficult for the reader to understand. In order to achieve such understanding, it is necessary to promote the work with statistics from the initial years of elementary education, based on the solution of contextualized problems, forming critical students, who observe patterns and variations within the data.

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