

LEME AS A MOTIVATING AND PLAYFUL AGENT IN THE TEACHING OF STATISTICS IN ELEMENTARY EDUCATION

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This paper aims to investigate, through a focus group with graduate teachers from the Statistical Multimedia Literacy Program - LEME, the possible contributions of Statistics to the playful and motivating experiences of young people from the 6th to the 9th years of Elementary School. Qualitative methodology was adopted, through a focus group composed of 12 undergraduate students from a university in southern Brazil, who acted as teachers in the program. The corpus of analysis of the paper was composed by the transcript of this focus group, which was submitted to the Discourse of the Collective Subject - DSC. The analyzes revealed that LeME is a playful and motivating agent, as its activities and class development encompassed the following playful-motivational factors: teacher/student approach; innovation; interest; student context; construction of knowledge autonomously; happiness and fun.

PRESENTATION

Based on a demand from society to develop skills in citizens regarding reading and interpreting information disseminated by the media, so that a subject can understand the reality in which he lives, Statistics was inserted in the curriculum for Elementary Education in Brazil in 1997 and 1998 (Ministério da Educação e Cultura, 1997; 1998). When we consider Statistics as one of the fundamental methodological sciences, being the basis of an experimental scientific method (Batanero, 2001), the inclusion of skills and competences related to this science in the school curriculum is justified (Ministério da Educação e Cultura, 1997, 2018; Franklin et al., 2007).

However, more than simply inserting this science into the school curriculum, it is necessary that the learning of Statistics has meaning and significance for students, encompassing in addition to cognitive aspects, the affective ones (Gal, 2002). Thus, to motivate learning is to relate schoolwork to the student's wants and needs. It is to present “incentives” that instigate in the subject certain reasons that will lead him to study (Barros, 2000, p. 113). Thus, the statistics can become playful to students, mainly through the role played by them in conducting research, ie can provide students feelings of pleasure, joy and well-being (Votto, 2018).

In this direction, this research aimed to investigate, through a focus group with licensed teachers from the Statistical Multimedia Literacy Program - LEME, the possible contributions of Statistics to the playful and motivating experiences of young people from the 6th to the 9th grade of Elementary School. It is worth mentioning that LeME, implemented in 2012, in a pre-professional school, located in the extreme south of Brazil, in 2019 received funding from the Carlos Chagas Foundation, expanding its development locus, to seven Basic Education schools, serving about 600 students from the 6th to the 9th grade of elementary school. The work methodology of the program consists in the development of Statistics workshops, taught by undergraduate students at the Federal University of Rio Grande-FURG.

THEORETICAL REFERENCE

The LeME was conceived from the concern to provide Basic Education students with the development of essential statistical skills to make them critical citizens (Kataoka; Silva & Cazorla, 2015; Gal, 2002), such as reading and understanding the information that surrounds our environment. Thus, the theoretical foundations of the program are guiding documents for Brazilian (Ministério da Educação e Cultura, 2018) and international education such as K-12 (Franklin et al., 2007), in addition to the requirements for Statistical Literacy recommended by Gal (2002), these comprise: a) knowing why the data is needed and how the data can be produced; b) familiarity with basic terms and ideas related to descriptive statistics; c) familiarity with basic terms and ideas related to graphic and tabular displays; d) understand the basic notions of probability and, e) to know how the conclusions or statistical inferences are achieved.

Gal (2002) points out that such requirements are related to the understanding of adults. However, we understand that for an adult to master such skills, it is necessary to gradually immerse oneself in statistical knowledge and skills over the school trajectory. The documents that guide Brazilian education have been doing this since 1997 with the National Curriculum Parameters - PCN (Ministério da Educação e Cultura, 1997; 1998) and currently with the Common Curricular National Base – BNCC (Ministério da Educação e Cultura, 2018). The last one inserts the teaching of Statistics explicitly from Early Childhood Education and Early Years, and throughout Basic Education, comprising graphic and tabular notions, comparisons and research.

In this sense, with regard to the organization and planning of pedagogical practices involving Statistical Education, Campos, Wodewotzki and Jacobini (2011) emphasize that it is important to provide students with the opportunity to produce their own data. This way, the teaching methodology adopted by the graduates of the LeME program was the Learning Projects (Fagundes, et al., 2006). They explore the principles of constructivism (Piaget, 1975), with the student as the center of the learning process and the teacher as a mediator and a guide. The differential of this methodology is that the student builds knowledge from the exploration of a research question that “bothers” him and excites his curiosity (Fagundes, et al, 2006, p. 29).

In addition to the inclusion of Statistics in the curriculum, it is relevant to highlight that Statistical Literacy involves the development of cognitive and affective components (Gal, 2002). In this direction, according to Gal, Ginsburg and Schau (1997), the role of attitudes and beliefs in Statistical Education can be reflected in problem solving. According to the authors, students need to believe in their ability to solve statistical problems, so we will probably be able to keep them motivated during the teaching and learning process. This way, the performance of the undergraduate students in LeME aims beyond the development of statistical learning, to provide students the recreational experiences.

In this study, we conceive playfulness from an internal dimension of the subject (Brougere, 1998; Chateau, 1954; Luckesi, 2002). In this, playfulness is understood as an internal phenomenon, since it emphasizes that different actions of the subject can provide him with feelings of pleasure, joy and well-being, transcending the use of materials, such as games and toys. Therefore, various actions, such as conducting statistical research and participating in group work, can be experienced as playful by students (Votto, 2018).

National and international surveys have shown that, throughout the schooling process, intrinsic motivation tends to decline. That is, students at the end of the Early Years and Elementary School, do not show the same curiosity, motivation and taste for the challenge, for the discoveries observed in the early years of childhood (Gillet; Vallerand & Lafrenière, 2012; Paiva & Boruchovitch, 2010). That said, it is justified the importance of studying and valuing motivation and playfulness in the planning and application of the workshops that are given to students in the Final Years of Elementary Education, which is when this decline in motivation is evident.

The importance of valuing the intrinsic motivation of students in the school environment, and in projects such as the present statistical literacy program, lies in the fact that it is able to develop enthusiasm and confidence in the subject, which has implications for both improved performance, persistence and creativity, as well as in the subject's well-being. (Ryan & Deci, 2000; Guimarães & Boruchovitch, 2004). We can say that intrinsically motivated students get involved and remain in the task for their own pleasure, challenge, curiosity and interest that the activity arouses. As extrinsically motivated students perform tasks to obtain external rewards and/or demonstrate their skills and abilities to others (Ryan & Deci, 2000).

METHODOLOGY

This paper presents a qualitative research (Minayo, 2008), based on a case study (Yin, 2001). According to Yin (2001), the case study is an empirical research focusing on a contemporary phenomenon inserted in some real-life context, and especially “when questions such as “how” and “why” are asked, when the researcher has little control over events” (YIN, 2001, p. 10). From this perspective, we present as a research question “How can the statistical literacy program (LeME) be configured as a playful and motivating agent in the teaching of Statistics in the Final Years of Elementary School?”

The participants in this study were 12 undergraduates from different areas of knowledge, from a university located in the extreme south of Brazil. These participants formed pairs and acted as teachers of the program. Regarding the activities developed with the students, each pair prepared specific pedagogical plans for each class, according to their reality, using games and different dynamics. Furthermore, a research project was common to all classes, inspired by the Learning Project - PA (Fagundes, et al., 2006). Although the way in which the steps of the PA are executed has also undergone adaptations according to the class. The steps of the statistical learning project developed with Basic Education students are detailed below:

1. Choice of Theme by the student: With students divided into groups;
2. Problematization: Discussion to raise hypotheses, usually within the groups themselves;
3. Choice of research subjects: The groups chose the people they would interview;
4. Creation of a Data Collection Instrument: Creation of a survey questionnaire;
5. Data collection: field, school, or in-class output;
6. Data analysis through Statistics: At this stage, visual material was constructed, such as posters, for later presentation of the results;
7. Disclosure of data: Oral presentation of each group about the results of their research.

To collect data for this research, we used a focus group (Morgan, 1997) with 12 undergraduates (professors of the program). Furthermore, five graduate researchers who make up the research team of the LeME program participated as mediators in the focus group. The focus group is defined by Morgan (1997) as a research technique that collects data through the interaction of participants in a group, it can be used independently or linked to other methods.

Used independently, the discussions highlighted in the focus group were mobilized from three guiding questions, which were specifically directed to the 12 undergraduates participating in the group, namely: “How was the process of planning the program's activities? Why did you choose these activities?”, “How was the development of activities in the classroom? Did you need some adaptation? Which? Why?”, “Did your participation as a teacher in the program (from planning to execution) contribute to your teacher education? In what way?”.

The aforementioned focus group, due to the Coronavirus pandemic, took place by videoconference in the second half of 2020, using the Zoom Meeting platform and lasted two hours. Subsequently, the recording was transcribed and the testimonies of the participants were submitted to the technique of analysis of the Discourse of the Collective Subject – DSC (Lefèvre & Lefèvre, 2005). The DSC makes it possible to analyze the collected verbal material, extracting from each of the statements the central ideas, and/or anchors and their corresponding key expressions, bringing them together to compose one or several synthesis-discourses in the first person singular (Lefèvre & Lefevre, 2005).

Thus, each of the guiding questions originated a discourse of the collective subject (this one consisting of excerpts from the discourse of the 12 participants), with its particularities. However, some factors about playfulness were recurrent in all speeches. These deal with the importance of playful and motivational elements throughout the entire process of LeME, from the planning, application of the workshops and final reflection of the undergraduates who acted as teachers. Later, we decided to reorganize the speeches and make a single speech. Therefore, the three original discourses were merged, generating a new one that aimed to answer the question “Which factors present in the program (LeME) make it potentially playful and motivating?”, which was entitled “Playful and motivational aspects considered in LeME”.

During the elaboration of this new speech, 7 central ideas were revealed, namely: Fun activities that provide joy and relaxation; Concern about student motivation; Teacher x student approximation; Valuing the interest of students in planning; Pedagogical strategy that goes beyond the use of the framework; Student involvement and excitement; Concern with providing legal activities, in which students build knowledge. The next section presents the discourse of the collective subject, the result of this research, and the discussions relevant to its understanding.

RESULTS AND DISCUSSIONS

Below we present the speech entitled “Playful and motivational aspects considered in LeME”, *The planning was thought of in the approximation student/teacher, the students embraced us and welcomed us very well. On the first day, we didn't take any jokes, so we explained it more using them*

to explain the measures of central tendency. Everyone had to participate, and that was really cool, we put five at the front with different statures, so people started to interact. Then, I thought about target shooting, because we did it at school, and the students accepted very well, they liked it a lot, we were able to work with that data. In addition, the interactive pie chart was one that we did in our training on Saturday, and I thought it was a lot of fun, so I thought maybe they could find it too. I think it was an activity that provided joy and relaxation with the class, in addition to Statistical Literacy. At the time of the development of the PA, each one spoke about the topic they would like to work on in the research, what they liked to do, what their interests were, and so make our class a bit like our students, because we really need to bring the student's context into our class. In PA they were very anxious, very excited to interview, they went to interview the teachers in the teachers' room, so they were lining up and we saw that they were smiling all the time, it was a really cool moment. In view of this, I feel that throughout our planning we tried to encourage students to continue with us, to be interested in what we were doing, and in a little while I could motivate them to continue in school. Furthermore, it is important to make sure that our students were impacted, that the activity was cool, that we were able to pass on that understanding and that they remember something that we discussed, moreover, that we are here, to build all this together, that they are capable and really proved it, because they produced beautiful works. In addition, the class asked if we were not going there again, so much that they liked it... excited, it was really cool. Anyway, I loved it. (Collective Subject Speech, 2021).

From the reading and analysis of the aforementioned speech, it was possible to apprehend several factors that were evidenced by the undergraduate students who acted as teachers of LeME, both in the planning of the activities proposed to the students, and during their development. These factors will be discussed in the sequence of this text.

We understand the relevance that the factor “teacher/student approximation” provided during the development of the workshops and activities with the students of the program. As well as in the closer and more affective relationship between these subjects, culminating in pleasurable, playful and interactive moments. In this regard, we consider Freire's perspective (2005, p. 85), that “teaching requires availability for dialogue”. In this sense, we understand that the movement of dialog between teachers and students in the development of the LeME program, has become essential for the process of approximation and creation of an empathic relationship between both sides. This factor contributed to the construction of students' knowledge in a critical and autonomous way.

In the course of planning, undergraduate students were concerned with transcending that hierarchical and content teaching model, betting on the “innovation” factor. Thus, they proposed to students innovative activities that were potentially playful and motivating, such as the Learning Project and statistical research. In fact, we emphasize that the work with the Learning Project methodology “can especially favor the learning of cooperation, with reciprocal exchanges and mutual respect.” (Fagundes, et al, 1999, p. 24).

Teaching through projects is recommended by official documents that guide Brazilian education, such as the BNCC (Ministério da Educação e Cultura, 2018). This emphasizes that the investigative spirit, the reading, the interpretation and the construction of tables and graphs are essential skills for students of all Basic Education. The skills mentioned in the BNCC are in line with what Gal (2002) recommends in the Statistical Literacy process. In this, the subject will develop some skills such as: understanding why the data is needed and how the data can be produced; familiarity with basic terms and ideas related to descriptive statistics; graphic and tabular notions; to observe how the conclusions or statistical inferences are obtained. This way, students used these skills to understand the reality in which they live, developing their criticality and ability to make decisions.

Furthermore, in the LeME workshops, games and activities were used. Being these, enhancers of the pedagogical practice (Brougere, 1998; Kishimoto, 1998), which together with the Learning Projects, are configured as novelties in the educational process. The news events and activities that are somewhat different from the students' expectations contribute to their motivation (Stipek, 1993). Such novelties and pedagogical strategies allowed the “construction of knowledge in an autonomous way”, being associated with a constructivist methodology, which helps in the formation of a proactive, questioning, critical and reflective subject, capable of being a protagonist and transforming agent of his/her reality.

In this direction, the practice developed by the teachers who graduated from the LeME program is based on Piaget's constructivist theory (1975), approaching the relational pedagogical model (Becker, 2012). This emphasizes the student as an active participant in the learning process and not a mere recipient of content, surpassing the vision of Banking Education (Freire, 2005). Furthermore, it emphasizes the role of the teacher as an advisor or mediator in this process (Becker, 2012), posture developed by LeME teachers.

A factor that is present in the constructivist theory is the valorization of the student's environment (Piaget, 1975). From this perspective, we perceive through the discourse presented, the teachers 'search to understand the students' reality, bringing their “context” into the classroom. In this process, we present Statistics through projects as a possibility of valuing the student's context, with statistical thinking developed in social contexts, an important part of Statistical Education, as it is from it that the subjects grasp the information that will be interpreted (Watson, 1997).

When bringing Statistics teaching closer to the students' context, another playful-motivational factor emerges, considered in the LeME program, that is, the “student interest”. This was valued, mainly, by conducting research with the Learning Project, which allowed students to research topics of interest to them, engaging in the activity of their own free will. According to Stipek (1993), this engagement in activities willingly is a component that contributes to the development of intrinsic motivation. Bearing in mind that interest is related to intrinsic motivation, one of the experiences that contribute to interest and the effort to learn is the feeling of doing what one wants or chooses, with autonomy and not by obligation (Schwartz, 2014).

Finally, we identified the factor referring to “joy and fun”, considering that the undergraduate students made it possible for students to have recreational experiences (Luckesi, 2002), that is, they experienced the feelings of pleasure, joy and relaxation during the activities, as shown the discourse analyzed in this text. Thus, based on the student's role and the mobilization of all the playful-motivational factors listed (teacher/student approach; innovation; interest; students' context; autonomous knowledge construction; joy and fun), we consider that the LeME program configured itself as a playful and motivating agent in the teaching and learning process of Statistics.

FINAL CONSIDERATIONS

The discourse analysis revealed a set of factors present in LeME that made it a playful agent, contributing to students' motivation. These were called *playful-motivational factors*. Thus, we can say that when the activities and the development of the class include the teacher/student approach, innovation, autonomous knowledge construction, the students' interest, the students' context and joy/fun, these can provide playful experiences to the students. The importance of promoting statistical learning that takes into account the factors mentioned above, resides in its potential to motivate students in relation to learning and the school environment, since research shows that students' motivation suffers a decline as they progress from one to the next level.

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