PERSPECTIVES IN TEACHING STATISTICS IN A PEDAGOGY COURSE IN DE

Auriluci de Carvalho Figueiredo and Michel da Costa
Universidade Metropolitana de Santos – Brazil
aurilucy@uol.com.br

Distance Education plays a fundamental role nowadays, and consequently, the formation of teachers. Our research group composed of teachers who have been working for some time with this training in face-to-face mode faced a great challenge: how to deal with subjects in Teacher Training courses in DE? So, the present article represents a larger research clipping on the subject, and we chose here to treat some possibilities of teaching and learning of Statistics in a Pedagogy course in a University of São Paulo in DE. Our concern among others was to combine statistical knowledge, articles in the area of Statistical Education and teaching practices. The study was carried out from the analysis of records in evaluative activities in the virtual environment that happened in the wiki tool.

INTRODUCTION

The use of technology in education has grown at a fast pace, and higher education has been no exception. In Brazil's 8.5 million km^2 territory, educational technology can dramatically improve access to higher education programs delivered in the distance education mode.

In the country, enrollment on distance learning programs increased by 12.2% in 2011-2012, in contrast with 3.1% for face-to-face learning during the same period (ABED, 2013). At the end of this period, over 15% of undergraduate students attended programs delivered under this mode, with teaching certification accounting for most students (40.4%), nearly half of whom attended pedagogy programs. Distance education continues to expand, with roughly 1.5 million students in 2016, or 18.6% of total enrollment in higher education (ABED, 2017).

As defined by Brazilian curriculum guidelines, pedagogy undergraduate programs confer first professional degrees for teaching in early childhood education, the initial years of elementary school, secondary school, and professional education programs in the area of school services and support (Brasil, 2006), as well as for other areas where pedagogical knowledge is required. In this spectrum, statistical knowledge finds it place both in the early grades of basic education and as a topic in the design of documents in the area of education. Furthermore, educators must be acquainted with statistical language, for the analytical perspective it provides and for its utility in making sense of the educational phenomenon (Silva Filho, 2014).

As professors on a teaching certification program delivered in the distance education mode at a university in the state of São Paulo, we have asked ourselves how to introduce our students to relevant research in the areas of mathematics education and statistical education since the first year, and how to contribute with statistical knowledge in their training as future teachers.

Drawing on group discussions, we considered the possibility of having students read articles addressing articulations of statistical knowledge with contents specific to the courses taught in the pedagogy program. In particular, attention has been devoted to the potential of using the Wiki tool available from the Moodle open-source learning management system as a collaborative resource for text production. Recent research in the area of statistical education served as the basis for this intervention.

SETTING AND FEATURES OF THE PEDAGOGY PROGRAM INVESTIGATED

Main features of the Pedagogy program in which we teach include semi-distance delivery mode—i.e., interaction between students and tutors can take place both face-to-face (with campus- and advanced-campus-based tutors) and remotely (with distance-mode tutors, teachers, and program coordinators, using a virtual learning environment); the Moodle Platform as a standard virtual learning environment, although other media (telephone, videoconference, etc.) can be added; management team and teaching staff comprising program coordinator, remote-campus coordinators, teachers, campus-based tutors, distance-teaching tutors, and secretarial assistants. Also, more critical evaluations are conducted on-site.

Of all courses in the curriculum, only two ('Statistics and education' and 'Mathematics teaching methods and practice') are directly related to mathematics. The present article addresses a subset of our work in the 'Statistics and education' course—namely, our approach not only to statistical contents, but also to recent statistics-related investigations in mathematics education. Roughly 1200 students attend this course each semester.

In the 'Statistics and education' course, semester evaluations also include two non-simultaneous activities. Students are given up to two weeks to address these activities. For the first, students individually prepare and upload a file. The other is a group activity that requires the Wiki tool. Both activities involve reading published papers in the areas of statistical education and mathematics education.

Supplementary evaluations consist of an on-site assessment with higher-weighted scores; five evaluations termed 'Learning verification'; and a distance assessment the students can perform at any convenient location. Establishing the chronological order of the readings is crucial for the activities based on published articles, so that students can combine specific content knowledge with possible glimpses of future classroom practices.

This article highlights our use of group activities in which students provide written responses using Moodle's Wiki tool in a collaborative manner. Collaborative approaches have been described as involving a teaching and learning process. Pimenta (2009) defines collaborative learning as a process where group members help each other achieve a shared goal. Campos *et al*. (2003) point out that this type of activity involves a pedagogical proposal that promotes a learning process founded on partnership among students and between students and teacher, with the purpose of acquiring knowledge about a given subject matter.

The Wiki tool promotes interaction by allowing any student in the group to rephrase output posted by another member, ultimately leading all five members to generate a shared-authorship essay. Technology provides the only locus for these students to interact, since they are geographically separated.

Once logged on, students join a forum and are invited to introduce themselves and type in their expectations about the course. This input, we have observed, often takes the form of sentences conveying a despondent note, such as "I expect it to be hard," "It involves math," "I'm not good at numbers," or "I fear I'll flunk in statistics."

We agree with Novaes (2004) and Biajone (2006) in that pedagogy students are often misled into selecting this program by wrongly assuming it does not involve mathematical content—a contradiction, since their subsequent professional practice will include the task of introducing mathematical and statistical concepts to students in the early grades.

TEACHING STATISTICS IN A VIRTUAL ENVIRONMENT: METHOD AND PRACTICE

The activity involves reading two articles. The first, entitled *Statistical Education in Childhood*, by Souza (2008), reports an investigation of the steps of a didactic-pedagogical approach to statistics in the early grades and the meanings that children attribute to statistics while participating in activities. These meanings emerge while discussing with the children about mathematical knowledge and the importance of context in working with statistical ideas.

The second article, *Games and Jokes to Teach and Learn Probability and Statistics in the Early Years of Elementary Education*, by Campos and Novais (2010), addresses the use of didactic sequences organized along two lines: 'Action' and 'Reflection within action'. The first line addresses the game and the activity script, while the second takes place while the activity is performed, encouraging pedagogy students to build knowledge under an investigative, play-related, creative approach, thus developing knowledge that makes sense and can be applied to daily life.

The students are tasked with drawing comparisons between the articles, so as to provide material for their collaborative essay on aspects such as contents related to the Brazilian Curricular Guidelines (Brasil, 1998); the school grades focused; the conclusions presented in each article; relationships between the statistical concepts taught on the pedagogy program and those addressed in the articles; and personal conclusions emerging from the readings, particularly in terms of knowledge gains.

To compose the collaborative essay, each group member and the teacher select a text color for authorship identification.

The colors also make it easier to observe the gains described in the personal conclusions section. These descriptions may address contrasts and similarities with the official guidelines for the teaching of statistics in the early grades; the manner research conducted in this area draws on this type of knowledge to expand the possibilities of classroom practice; and how the articles address the use of graphs and statistical tables. The students are also encouraged to comment on the differences between what is actually taught on the pedagogy program and how they expect to approach the same topic with their own early-grade students.

ANALYSES AND FINAL CONSIDERATIONS

Pedagogical content knowledge, one of the concepts developed by Shulman (1986), implies that teachers need a veritable arsenal of alternative forms of representation available, some of which are derived from research, while others will originate from practical knowledge.

Investigations in mathematics education and statistics education have expanded the possibilities of teaching. On our pedagogy program, we have been exposing students to a number of these possibilities, allowing them to build their own knowledge arsenals, which should prove useful in their future careers as teachers.

A number of aspects regarding the difficulties faced by pedagogy students while attending the statistics course have often resurfaced in the collaborative essays. These aspects include overcoming their own fears in dealing with this area of knowledge; recognizing the importance of statistical knowledge not only to their future students, but also to themselves as citizens; and identifying effective methods for teaching statistics to children.

As highlighted by Batanero (2000), applying statistical knowledge provides excellent opportunities for students to perceive the usefulness of mathematics for solving real-life problems. In our classes, inviting pedagogy students to compare two articles addressing teaching practices allows them to expand their conceptions of statistics and the teaching of this subject.

Lopes (2003) aptly stresses that children's education should prioritize access to a range of languages and representations, and explains that engagement in experiments that involve collecting, representing, and interpreting data within the context of students can broaden their set of competencies.

Online instruction is similar yet different from face-to-face teaching, requiring different, or even novel, teaching skills and strategies.

Working with teacher training has shown us that distance education constitutes an area with ample opportunities to be explored for the education of statistics teachers. As stated by Heuer and King (2004), the new role of instructors as facilitators/teachers makes them both guides and learners.

They should be trained in this new mode of instruction to facilitate students' success and further promote online participation, while evolving in the art of becoming effective online guides.

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