PROMOTING POSITIVE ATTITUDES TOWARDS STATISTICS IN PEDAGOGY STUDENTS THROUGH PROJECT WORK

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Unsatisfied with the negative attitudes towards a Statistics course that are common among Pedagogy students, the author and instructor of that course believes that these attitudes are very likely to be the result of traditional teaching approaches that emphasize the mathematical and computational aspect of statistical knowledge. Eager to change these negative attitudes to positive ones, the author decided to utilize project work in a student cooperative environment. As the course went on under this new approach, this option not only demonstrated the possibility of changing these attitudes, but it proved to be a valid professional development experience for the instructor himself as well.

INTRODUCTION

In Brazil there is an education related undergraduate academic program known as Pedagogy. Those who graduate in this program are qualified to work as Elementary and Middle school administrators and directors.

In its core curriculum, there is a statistics component which is the only course related to Mathematics in the entire Pedagogy program of study and for this reason, the majority of Pedagogy students are usually scared to death even before enrolling in this particular course.

In fact, if in the very first day of a statistics course these students are given the opportunity to express their expectations related to this subject, it is very likely that they will present a variety of odd perceptions towards it: fondness, pleasure, fear, anxiety, despair, rejection, indifference, antipathy and even contempt.

In these moments it is not rare to hear from some students that their choice for Pedagogy was based upon the fact that this course is one of the few undergraduate ones with "the least amount of mathematics components to study for."

In Brazil, this negative correlation between Statistics and Mathematics is usually common in Statistics students from social and human sciences related fields and among its possible causes, is the one which derives mainly from the way statistics is taught; in other words, from the too *excessive mathematical approach* to teaching statistics (Murdock, 1983; Bradstreet, 1996).

Even though many studies (Cobb, 1991; Hogg, 1991; Bradstreet, 1996) have confirmed that this situation needs to be changed in order to provide students with a meaningful statistics education that allows them to understand today numerical world (Branco, 2000), the excessive emphasis on computational techniques and formula memorization remains as one basic feature and is taken as a teaching approach. This approach is deeply rooted in many Brazilian undergraduate academic programs where Statistics exists as a component.

There are even researchers who went a little further on this discussion and suggested that Statistics should be taught by Statisticians rather than by Mathematicians (Moore, 1998).

It is my belief, however, that this impasse does not reside in the fact of who should teach or not Statistics, but in *who is willing to find and explore alternative and meaningful ways to do it*. If the great majority of our students perceive Statistics as a set of formulas, proofs and repetitive exercises without a context, it seems to me that they have not been given the opportunity to learn Statistics by experiencing it (Snee, 1991; Garfield, 2002).

Would it be then the case of providing a proper teaching approach that would allow these students to perceive a different statistics? According to Snee (1993) people at the University "will study and make use of the statistical thinking when they experience its value" and learning a statistics that deals with real-world problems related to their field of study would certainly generate a more favorable attitude towards this subject and a greater desire to use it in their future career.

Since there is a growing consensus that Statistics should move away from mathematics approaches and place its emphasis on data collection and problem-solving processes, I decided to

develop a Statistics course in the form of a *statistical project* for my Pedagogy students, starting from their interest to investigate a theme related to their future career.

My option for project work is due to the recommendation by several authors who have pointed it out as an alternative teaching approach, which allows experiential active learning rather than passive learning via lectures (Cobb, 1991; Smith, 1998; Ponte, 1990; Branco, 2000).

Thus, the foreseen discipline topics were taught through and for the development of the project, allowing the students to have a hands-on experience in collecting and interpreting the data needed not only to clarify the theme of their very interest, but also to perceive value and usefulness in the statistics they were learning.

Below I will describe the experience of applying project work to teach statistics to Pedagogy.

THE STATISTICAL PROJECT

The statistics discipline in a Pedagogy course in Brazil is usually one-semester long and I planned the course so that a single statistical project was to be developed by the students during the entire semester.

Since there is hardly any difference between the phases of a typical project work and the statistics investigation method (see table below), it was clear to me that letting the students develop a project of their own would provide them the opportunity to *learn statistics by doing statistics* through its several phases of investigation (Smith, 1998).

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<tr><th>Statistical Method Phases</th><th>Project Work Phases</th></tr>
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Table 1: The correspondence between the Statistical Method and the Project Work phases

As mentioned before, the statistical contents of the discipline were presented and taught to the students as their need emerged during the development of project phases. Hence, it was possible not only to promote an efficient integration of these contents to the context they were being used, but also to redefine mistaken attitudes and beliefs common among our Pedagogy students such as “Statistics are nothing but formulas to memorize and exercises to solve”.

GETTING THE PROJECT STARTED

According to Ponte (1990), working with projects has the biggest advantage of letting the student free to decide what he or she wants to investigate, and presenting the subject matter as a tool for developing the project. Thus, I started the course in August of 2004 (Fall semester) by asking my thirty-one Pedagogy students what they wanted to investigate with the help of Statistics.

They were also informed that they would develop the entire project working in small groups of three to five students each. The idea behind the group work was to encourage students to construct knowledge as they learned new material, and transform our classroom into a “community of learners, actively working together to understand statistics” (Garfield, 1993).

This perspective of working cooperatively in small groups was also a unique opportunity to give students practice in developing problem-solving skills, decision-making processes, learn to respect other viewpoints, other approaches to solving a problem, and other learning styles as well.

Henceforth, I told the students that my role as their instructor would be changed from the traditional "source of information" to "facilitator of learning", thus becoming an ongoing assessor of their learning, as well as an extra partner they could even count on in their group work.

That being said, the students organized themselves into seven groups and each one of these was asked to come up with a name for itself, in order to strengthen its internal cohesion, sense of belonging and mutual concern. The names chosen were quite interesting and showed how each group perceived themselves:: The Discrete and Continuous, 100% Education, The Enlightened Ones, The Unbearable Four, The Mighty Girls, The Pioneers and Crystal.

Once the groups were set, they voted to select the theme of their interest; something they wanted to investigate with the help of Statistics and that was related to their future career. The winning theme from all the competing choices was *"what do elementary teachers of our town think about integrating handicapped students in regular schools."*

However, due to the fact that there were seven groups and some students did not like the chosen choice, I suggested to divide the theme into seven related "sub-themes" or focuses, so that the groups would now have the chance to work on something of their *entire interest within the main theme*, as well as to develop each phase of the project according to their own data collected and ultimately perceive that their contribution was vital for the understanding of the project as a whole.

The seven groups and their respective focuses were as follows: 100% Education – "Teacher development for teaching handicapped students", the Enlightened Ones – "Benefits of education of handicapped students"; the unbearable four – "Types of handicaps"; Crystal – "Prejudice"; the Mighty Girls – "Teachers attitudes towards the inclusion of handicapped students"; Discrete and Continuous – "Physical conditions of classes that provide inclusion of handicapped students" and the Pioneers – "Physical conditions of handicapped students classes."

FROM PLANING TO EVALUATING THE RESULTS

Since our Statistics course only had a session per week, by the end of August the focuses were determined and the groups were searching information on the internet and in the college library in order to better understand these focuses and help creating a few questions about them that would serve to make up our questionnaire.

Once this task was accomplished, there was a total of twenty five questions in our questionnaire. These questions were then checked by a specialist in handicapped education before the questionnaires were delivered in the Elementary schools.

Prior to their delivery, a sampling of the teachers who would receive them was done. That was the moment where I presented the topic of sampling to the students and using these techniques, our sample ended up with thirty-two teachers.

By September, the groups and I visited the schools, spoke to the teachers and left the questionnaires. By the end of that month, the data were returned to us and each group started to organize them according to their respective focuses into tables and graphs. Here, the aid and the use of the computer were essential, since the amount of information the groups had to process and deal with was large and for some students it was actually the first time they were using a spreadsheet to organize data and build graphs.

Besides, working with real data caused some students to be excited and desirous to go deeper into the focus they were investigating. Doubtless, we did not face the perspective raised by Smith (1998) in his studies: "the problem with relying on examples done by others is that students remain passive participants and do not experience firsthand the many issues that arise in data collection and analysis."

Once the data were organized, by mid-October, I presented to the class the topic of statistical summaries, including the average, median and mode, and in order to have a better analysis and interpretation of the data within the perspective of their focuses, each group utilized theses three measurements to built their final conclusions.

By November 6th, the last day of class in our semester, each group presented its work orally and also gave me a final written report containing the conclusions for its focus.

That day in particular was a grand moment for all of us, since it meant not only the completion of the project last phase, but of a whole semester of hard work towards the goal of

providing the Pedagogy students a meaningful experiential learning of Statistics, as well as the understanding of the usefulness and value of this subject to their future career as school administrators.

What about their negative attitudes towards Statistics? They have definitely changed to positive ones. Here are some answers collected from a questionnaire given to the groups at the end of the semester.

"We definitely have a different idea of what statistics is about after this course. We from this group really hate everything that has to do with mathematics and when this course started we knew we were going to hate both the course and the instructor as well. Luckily for us (and for you), you came along with this idea of project work and saved us all. Congratulations!" The Unbearable Four.

"We enjoyed learning statistics by doing statistics with real data collected by us and worked in our classroom. Without your idea we wouldn´t have accomplished a better understanding of the statistics and how it is related to our career, Besides, you as the instructor were always very helpful and assisted us every moment of our work with the project. Thanks from our hearts, Jeff! The Pioneers.

Furthermore, approaching Statistics through a project ended up being appointed by the class as a potential teaching methodology for other disciplines as well.

"The idea we now have of statistics is completely different from what we are used to hear from other students. We had a statistics that really will count for our professional and personal lives and we are sure that if your experience is shared among other instructors in this very college, many other subjects would also be meaningful to the students. Thanks a lot, Jeff! Crystal.

Experiencing Statistics through project work was also an opportunity to show the students that an instructor does not know everything and he or she can learn *with and from* students as well. Indeed, I not only had the chance to learn about a theme I knew little about, but also to improve my own practice of teaching Statistics.

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