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REFEREED PAPER
USING CUSTOMER SATISFACTION SURVEYS AS A TEACHING RESOURCE
IN STATISTICS EDUCATION: METHODS AND BENEFITS

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ABSTRACT
This paper examines how customer satisfaction surveys can be used as a tool for effective engagement of students who are learning introductory statistics at the tertiary education level in topics which have practical relevance for their future employment and enable an outreach into their communities. We first outline some of the core characteristics of customer satisfaction surveys, and then provide illustrative examples which demonstrate the advantages of including data from such surveys in the undergraduate statistics curriculum, e.g., with regard to going beyond technical analysis into issues of measurement, sampling methodology, data presentation, and more. Such an approach has the potential to improve students' understanding of statistics as well as their ability to interpret and discuss the results of statistical analyses within a real-world, employment-oriented context.

INTRODUCTION

Statistics educators teaching introductory statistics at the tertiary education level face numerous challenges. One such challenge is how to make the fundamental technical and conceptual knowledge acquired within an introductory statistics class appear relevant and interesting to students. This is an issue of *motivation* and well documented by numerous researchers (e.g., Gordon, 2004; Ograjenšek and Bavdaž, 2003; Papanastasiou, 2005). One solution to this challenge proposed within the statistics education community has been the use of real and engaging data. Numerous relevant sources of data have been identified, each with its set of pros and cons. Examples are datasets published by institutional data providers or official statistics agencies (e.g. official surveys, the frequency of any given name in the population); results from experiments that students perform on their own; or the use of data collected through surveys that students either design and conduct themselves, or access through repositories of data collected by students in other locales, for example in the CensusAtSchool project (Davies, 2011).

Another challenge involves the process of connecting the knowledge gained within the class to the roles that statistics may actually play in learners' lives later on, when they pursue their careers, act on their rights and responsibilities as citizens and community members, etc. This is an issue of *skill transfer* which to date has been only scarcely accounted for in the literature on statistics education.

With the above as a backdrop, this paper focuses on what might appear at the first glance as a yet another approach to creation and use of real data: the use of *customer satisfaction surveys and data emerging from them.* For us, such surveys offer both a source and context for data and their use has numerous advantages that go well beyond those achieved by other sources mentioned in the literature, and can help to prepare students for their future careers and/or involve employers in the educational process.

In this paper we first briefly outline some of the core characteristics of survey research, describe the concept of customer satisfaction and customer satisfaction surveys, and then provide a rationale and illustrative examples which demonstrate the advantages of including data from such surveys in the undergraduate statistics curriculum. We conclude with an overview of issues involved in implementing the proposed method in the classroom. Before continuing we note that customer satisfaction surveys are usually seen as connected only with business studies, but as explained below they should also appeal to non-business students, and the implementation ideas

can be easily adapted to serve diverse types of tertiary level introductory course on statistics.

THE LINK BETWEEN SURVEY RESEARCH AND STATISTICS EDUCATION

The use of surveys and data from them in statistics classes requires that statistics educators are clear about how surveys connect with the goals of teaching statistics. These goals are quite open, with the two dominant expectations being creating people who can think like statisticians ("Producers"), or creating informed and critical users of statistics ("Consumers") (Jolliffe, 2003). Yet, it turns out that survey research itself is not viewed as a unified field of knowledge. Groves (1987) argues that the field of survey research has evolved through the somewhat uncoordinated contributions of statisticians, psychologists, political scientists, sociologists, and others, and is not in itself a discipline with a common language or set of principles.

This heterogeneity is reflected in the existence of different perspectives on survey quality, two dominant and established ones being the perspective of mathematical statistics (thinking in terms of bias and variance) and the perspective of psychometric theory, generally adopted by the social sciences (thinking in terms of validity and reliability of the measurement instruments, and hence of the inferences they support). Against this backdrop, Groves (1987) has differentiated among numerous roles that people involved in surveys could adopt, such as *data collectors* (generally not worrying about quality issues, substantive issues and technical aspects of analysis), *analysts* (assuming different interviewers or surveyors would obtain the same result from the chosen sample and focusing on substantive issues), *describers* (focusing on descriptive statistics and errors of non-observation based on the perspective of mathematical statistics), as well as other roles such as *modelers, measurers,* or *reducers.*

Introductory statistics courses at the tertiary level generally tend to address only some of the above roles (e.g., data collector, analyst). Further, personal experience teaches us that statistics are often taught in a vacuum in which no relation is established between substantive, methodological and technical issues. As a result, even if students understand the technical aspects of a statistical analysis, this understanding is disconnected from issues regarding survey methodology and quality (which can affect the interpretations given to the results of the analyses), and from substantive or conceptual issues (i.e., what are the constructs being analyzed, such as attitudes or needs or positions that respondents have on issues of interest, and why are they operationalised as they are in the actual methods used). Consequently, students may know how to manipulate and analyse data given to them and how to represent it in different graphical and/or tabular forms, but may not understand the deeper meanings of the data and findings, since there is no true "need to know" (i.e., the data are not connected with a meaningful question that has consequences in the real-world) and the context is not fully understood.

In the framework of a tertiary level introductory service courses of statistics, the dangers of teaching statistics in a vacuum are notable. We believe that the use of customer satisfaction surveys can help to reduce the limitations of current teaching and learning practices. Such use also has the potential to serve both "producer" and "consumer" perspectives as well as motivation and skill transfer issues, through outreach to the employment and community worlds from which customer satisfaction surveys and data emerge.

SURVEY MEASUREMENT OF CUSTOMER SATISFACTION

As argued in the previous section, there is a need to establish a connection and maintain continuity between substantive, methodological and technical issues. With that in mind we look at three interlocking parts that illustrate a possible flow for ideas and discussions that may proceed in the classroom. Further ideas about implementation appear in the closing section.

Conceptual/substantive underpinnings. The discussion of a survey of any phenomena of interest to society requires some understanding of its meaning. Most students are probably familiar with the notion of "customer satisfaction" and would know that it relates to customers' judgement about a product or service (Oliver, 1997). Yet, the professional and scientific literature on service refers to two related but separate constructs: "customer satisfaction" and "perceived service quality." Full treatment of this complex topic is not possible in this brief paper (see, e.g., Zeithaml, Parasuraman, & Berry, 1990; Oliver, 1997). That said, we note that judgements of service quality are usually seen as more cognitive, based on "excellence" perceptions, and

constituting evaluations of specific attributes (e.g., cleanliness, speed), whereas satisfaction judgements are often seen as more emotional reactions that refer to less tangible and more personal referents such as need, enjoyment, or fairness. In this paper we refer only to "customer satisfaction", given that the concept is already familiar to students and part of everyday jargon. Furthermore, in reality service organizations usually do not distinguish between customer satisfaction and perceived service quality when designing surveys of customers, i.e., aspects of both of them are covered through different types of questions included in a survey, or by adopting a mixed method approach, i.e., collecting both quantitative and qualitative data.

From conceptions to a measurement framework. Service organizations in all sectors need to know how well they are satisfying customers' needs and expectations. To that effect, they have to translate general conceptions of customer satisfaction into concrete decisions about what to measure and what methods to use to collect data. It is important to explain to students the need to have a conceptual model that maps the key dimensions of the target construct as a basis for creating items in a questionnaire. A useful starting point in this regard is to describe the development of the SERVQUAL model (Zeithaml et al., 1990), a widely used model which views service quality as the gap between *expected* (what I want) and *perceived* (what I get) service attributes. The model specifies five key themes which research has shown that customers care about, and therefor service providers may want to measure in a survey: *tangibles* (physical facilities, equipment, appearance of personnel, etc.); *reliability* (the service provider's overall ability to perform the promised service dependably and accurately); *responsiveness* (willingness of front-line employees to help customers and provide prompt service); *assurance* (knowledge and courtesy of employees as well as their ability to convey trust and confidence); and *empathy* (individual care and specialized attention that employees and the company provide to customers). While other models do exist, and while not all of these five dimensions may always cover the essential aspects of service in all sectors, research has shown them to be stable and relevant across many industries, thus serving as a good starting point from which to discuss methods.

Methodological and practical considerations. Once a conceptual model of the construct is in place, service organizations face a wide range of applied isues. They need to discuss measurement issues, i.e, how to design a questionnaire that covers the key dimensions deemed important for the customers of that firm (Cronin & Taylor, 1992). Further, there is a wide range of methods and technical issues associated with collecting survey data about customer satisfaction. For example, data can be collected via different *modes* (printed surveys, phone surveys, Web/online survey). The *length* of the survey can vary considerably, from brief surveys involving 3-5 questions (such as customer reaction cards in restaurants) to longer surveys with 20-40 items covering the full range of SERVQUAL dimensions, or others. *Sampling methodology* may involve different techniques and sample sizes, e.g., organizations may use small convenience samples (e.g., a restaurant hopes that some customers respond to feedback cards), or large random, stratified samples that are carefully designed to represent a whole customer base or nation. Finally, surveys may be conducted on a different *temporal base* (daily, monthly, yearly). These and other related issues not mentioned here for lack of space, in combination, affect the quality, representativeness, credibility, and comparability of survey data.

Beyond discussing the technical issues outlined above, we believe that students need to understand where data come from, grapple with at least some of the considerations affecting the choice of research methods in the real world, and also develop some sensitivity to limitations of quantitative techniques (Gal & Ograjenšek, 2010). They could be introduced, for example, to the idea that methodological decisions about sample size and data collection mode (e.g., face-to-face interview vs. a phone interview) imply costs in terms of money, time, and other resources. A class discussion could examine the advantages and disadvantages of covering all or only some of the five dimensions and the number of questions used to assess each dimension, pointing to issues such as the depth of understanding of how customers feel/think about a range of topics, speed and cost of data collection, respondent burden and its impact on possible respondent dropout and how this affects the quality of the resulting sample and data, and so forth.

WHY USE CUSTOMER SATISFACTION SURVEYS IN STATISTICS INSTRUCTION?

The goals of statistics courses are usually described on two levels, one pertaining to the

material to be covered (descriptive statistics, correlation, probability, etc), the other relating to "hopes", i.e., students will think as statisticians, behave in a statistically literate way as adults, whether as "producers" or "consumers" of data (Gal, 2002; Gould, 2010). However, on a more tangible level, a key role of statistics is to support managerial functions and enable informed decision-making in organizations. The service sector is by far the largest employment sector in most western societies, and thus the sector in which students are most likely to work. That means that students are bound to bounce into the concept of customer satisfaction sooner rather than later in their professional life. A discussion of customer satisfaction surveys (including conceptions, methods, instrument design, data analysis, reporting, and so forth, as illustrated earlier) can therefore demonstrate the actual uses of statistics and of selected research methods issues in the world of work, and show students the relevance of what they study to workplace processes.

Beyond the above, the proposed approach has additional advantages, such as the following:

1. *Enhanced experience, relevance and motivation.* All students are clients of some service organizations, and many know of somebody working in such organizations. Hence, the contexts within which customer satisfaction data are generated, the reasons for collecting such data, and the possible ramifications for service organizations of "good" or "bad" findings can all be intuitively meaningful and easily understood by students.

2. *Improved grasp of situational constraints and their effect on analytic methods.* The context within which customer satisfaction data are collected lends itself well to presenting the need for data reduction and selectivity in presenting results. Students will understand that when longer surveys are used, it is not possible to analyse and present to management results for each question separately. Rather, data have to be grouped and formed into broader indices (or factors), e.g., calculated as the average of several simple items. Hence, students can play with levels of aggregation both during the analysis stage and in class presentations.

3. *Naturally create a need for statistical comparison.* One of the key limitations of working with a single dataset is that it does not satisfy a real "need to know"—it only simplifies the introduction of procedures and of a variety of technical manipulations of the data. In contrast, when customer satisfaction surveys are analysed, the data naturally lends itself to the comparisons that all organizations must make in the real world, whether of results from the current survey to a prior survey ("Are we improving over time?"), to other organizations ("Are we doing better than the competition?") or even to other sectors (the latter is the underlying logic of the American Customer Satisfaction Index (Fornell et al., 1996).

4. *Strong justification for using technology.* Not only can we link statistics to methodology, but demonstrate how this link is supported with modern technology when detecting trends, comparing samples, showing trends dynamically in time (as Rosling [2010] manages to do very successfully), visualising data in 3D, etc.

5. *Transfer of skills.* By designing and testing a questionnaire, going through the process of data collection, data matrix creation, data cleaning and aggregation, data analysis and interpretation as well as report preparation and delivery, students face challenges similar to that on their workplace. (This can be of benefit regardless of whether their job description will be that of an analyst or an informed consumer of other people's survey results).

We believe that statistics educators who seek ways to enhance the perceived relevance of key ideas being taught, will be able to find further items to add to the list above.

DISCUSSION

One of the main problems statistics educators working in a tertiary introductory statistics context usually face is a crowded curriculum. We thus envision different ways or levels of involvement at which customer satisfaction surveys can be incorporated into instruction. Perhaps

the simplest way, though a superficial one, is to refer to such surveys throughout the course as illustrative examples for contexts in which surveys, and hence the statistical design and analysis they require, are an inherent, needed aspect of organizational life and of relevance to students' future careers.

At a more involved level, customer satisfaction surveys could be used as a context for discussion of methodological topics that emerge at different stages of an introductory course. For example, students could be asked to find real-life examples of satisfaction questionnaires and evaluate them from a methodological perspective, e.g., in terms of quality of question phrasing and type (open-ended, Likert-type, etc), discuss measurement scales for different clusters of items, or prepare a codebook which is the basis for datafile creation. Using a specific questionnaire and its items and length in mind, students could be asked to discuss how they would approach sampling, e.g., needed sample size, how to get enough respondents, coping with non-response, and how these affect the representativeness and credibility of the resulting data.

Going beyond survey design and sampling, using a specific questionnaire that they analysed earlier, students could reflect on the information needs of the real users of that survey, e.g., a manager or a business owner. They could be asked to generate different questions of interest to the users who designed that survey, and reflect on how the data could be analyzed in order to answer such questions: how the data can be visualized, or what techniques could be used to address descriptive (e.g., "how satisfied are our customers") versus inferential questions (e.g., "are customers who come in during peak hours less satisfied than those who come during relaxed times"). In our experience, students often experience a statistics course as learning a series of disconnected procedures without understanding when they can be used and for what purpose. Thus, there is an educational benefit in turning the process around, by starting from real questions of data users, and then have students reflect on the value of different statistical techniques in this regard.

A deeper level of usage of customer satisfaction surveys is via using data from real surveys generated by service organizations in the community, as a basis for class analysis which the instructor performs in front of the class, or for students' projects. In our experience, organizations (especially small ones) often lack skilled employees to carry out advanced statistical analyses. Hence, they either have to hire expensive consultants, or conduct a superficial analysis of the data on their own, if at all. As a result, service organizations will often be willing to share data (once anonymity arrangements are worked out), in exchange for receiving free analytical insights.

Another approach that has the potential to boost student motivation and prepare them for career life, is to solicit guest lectures. It turns out that both employees of market research agencies and representatives of service organizations (commercial, public, nonprofit) enjoy visits to classrooms. For market research agencies this is an opportunity to present themselves and their activities to potential future clients. Managers like to share their views on how results of what the corporate world nowadays refers to as 'business intelligence' influences their thinking and describe business decision-making processes.

Overall, the ideas sketched in this paper suggest that statistics instruction can link substantive and methodological issues via problem-based elements, i.e., focus on the "need to know" that exists in real workplace situations. This can help students to see that in real life, they may be in positions where they are both "consumers" and "producers" of data (Gould, 2011), and realize that numerous statistical and methodological issues are part and parcel of every research process in applied settings and hence familiarity with the logic and technical details of statistical analysis is imperative. Of course, such expectations have to examined in future research.

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