ELEMENTARY STATISTICS INTERNATIONAL TRAVEL LAB COMPONENT

Robert A. Leslie
Agnes Scott College
USA

A travel lab component in elementary statistics is envisioned as a statistics lab within the context of a foreign setting. This paper will focus on why this is important and how the learning of statistics can be enhanced due to participation in such a lab. The travel lab component to Nicaragua in 2000 dealt with the extreme poverty among women and children. In Cuba in 2002, it will be on the status of women in contemporary Cuba. Many students appear to have an interest in humanitarian issues and even expect to see values discussed in their college courses. Thus they find this application of statistics in social context not only interesting but also relevant. I believe that through this type of travel component the utility of statistics becomes evident and students are better able to appreciate statistics studied and used in context.

INTRODUCTION

The motivation for this paper has several sources. One is to describe the nature and experience of conducting an international travel lab component within the context of teaching an elementary statistics course. Another motivation is to explore the logic or rationale behind such a concept. And the final one is to review the success, as much as possible, of these international travel labs since they began in 2000.

One of the challenges in teaching elementary statistics is that there are students in the class with varying backgrounds and majors, from first year students to seniors. This means that students will have different levels of cognitive development. Perry (1970) describes nine levels for those in their college years. Many have explored the implications of Perry's cognitive development scheme for learning and educational practice. Belenky, Clinchy, Goldberger and Tarule (1986) identify in a condensed way four such levels applicable more so to women. One of these categories is what she calls "multiplicity" or subjective knowledge. At this level one is challenged to think independently in the face of conflicting ideas and opinions. Often elementary statistics students would not expect to find this kind of independent thinking required in an elementary math oriented course. The international travel lab component encourages students to confront the ideas outside of the classroom in an open but also sometimes threatening setting. It is definitely a new learning experience for many students.

College students in general exhibit certain expectations regarding the courses they take and often the expectations they have regarding the elementary statistics course are different from those that they have of many of the other college courses they take. As a result, unfortunately, these pre-conceived and often immature notions limit what many students are able to learn in an elementary statistics course. Thus one of the broad goals in teaching this course is to change students' notions of what a math or statistics course is like. There are various ways to try to do this, but one way which has been useful is this international travel lab component. When students first hear about the opportunity to travel and practice statistics at the same time, they immediately know that something is going to be unusual about the course. The focus of many of their assignments concerning the subject topic in another country makes the work more interesting, relevant, even memorable and compelling.

DESCRIPTION

The following is a brief description of the one semester introductory statistics course which is taught each semester and how the three-week travel lab component is designed. In the regular semester course the text used is by David S. Moore, entitled *The Basic Practice of Statistics* (2000). Frequent use of the *SPSS* software is fundamental to the course. The course is taught in the spirit of Moore's book with an emphasis on data analysis and includes a number of intensive writing assignments. The three-week international travel component follows at the end of the Spring Semester and functions as a "lab" or applied course supplement. It is not required that students participate in the travel lab in order to receive credit for the semester course but

those who do receive two additional credits for this component. Prerequisites for the lab are an introductory statistics course and at least one course in social science. Although it is not a prerequisite for the course, some knowledge of the language of the host country is helpful. Language interpretation is provided when needed. I speak Spanish and thus far our trips have been to Nicaragua and Cuba, both Spanish speaking countries. There were eight students on the Nicaragua trip in May, 2000 and twenty have registered for the May, 2002 trip to Cuba. The ideal number I believe is somewhere between sixteen and twenty.

The design for the travel lab fits with an existing College program at Agnes Scott College. All students are encouraged to study abroad and the College offers two specific programs: The Global Awareness Program and The Global Connections Program. The Global Connections Program involves students registered for an established semester course, in my case Elementary Statistics, who then may opt for additional credit at the end of the semester by participating in a two to three week intensive global experience. (i.e. study trip to a foreign country). *Also it is important to note that the College pays half the expense for each student to do one such Global Connections course in her college career.* Usually there is one faculty member who leads the study trip and another member who acts as an assistant. The faculty leader receives a stipend for the lab component and both faculty members receive all expenses for the trip. In addition, the faculty leader's expenses for a pre-trip site visit the summer before are covered.

The general goals for the international travel lab component are:

1. *To provide students an opportunity to extend their learning beyond the classroom into an international setting as an interdisciplinary experience.*
2. *To gain experiences of the situation in this country through first hand interviews, which could not be done in the classroom or even remotely through the Internet.*
3. *To find and consider relevant data sources and to deepen the appreciation for adequate data. (No new statistical topics are taught nor surveys conducted although some review lectures are given).*
4. *To reflect on hypotheses about the topic using these sources especially in light of these experiences.*

The international travel component to Nicaragua appeared in the course catalog as: *A Statistical View of Nicaraguan Socioeconomic and Cultural Change. An interdisciplinary study of 'third world' development in Nicaragua involving economic, health, agricultural, environmental, educational and other statistical indicators of the changes during the recent years of three different governments: Sandinista, 1979-1990, Chamorro, 1990-96 and Alemán, 1996-2001, focusing specifically on the effects on women and children.* That of the current travel component to Cuba appears as: *A Statistical View of the Status of Women in Contemporary Cuba. An interdisciplinary study of the status of Cuban women from an economic, health, family, community, political, religious, racial and educational point of view using various statistical indicators in Cuba, and focusing specifically on the ramifications of the Cuban revolution during recent years.*

To execute this international travel lab component requires an in-country host, an organization who knows the country well and has experience planning study tours. Through such a host, a daily schedule of interviews with "experts" in various areas is arranged. Some of these interviews are with personnel from the government, others with students and faculty at universities, others with NGO's and others with private individuals. These occur during the daytime; usually two to three interviews each day. To accomplish this the group travels within the country to various sites both urban and rural where it is possible to spend time in communities to see how people live on a day to day basis. Several days are spent in home stays with families for one or two nights. Each evening, time is reserved to reflect on what has happened that day. Students take turns in leading these discussions. Also students keep daily journals noting their own personal impressions of what they have seen, heard and felt. Through these experiences students began to see what the country is really like and begin to understand the reality behind the statistics they have studied in the classroom and their textbook.

Also students are required to attend six bi-weekly, two-hour orientation meetings prior to departure and to participate in the various interviews and other aspects of the trip. As mentioned, each student is required to keep a daily journal, which is reviewed and evaluated toward the end

of the trip. In addition each student is required to write a five to six page paper concerning some aspect of the topic for the course. It is due a week after returning from abroad. The journal is evaluated for its clarity, completeness and depth of perception. The paper is evaluated on how well it is written and the manner in which it statistically addresses the subject.

RATIONALE

Researchers in learning theory and cognitive development have studied ways in which students learn. Previously mentioned are the works of Perry (1970) and Belenky et al. (1986) who outline different levels of cognitive development in college students and how the existence of these levels can prevent students from reaching certain classroom goals. In Belenky et al. (1986) portrayal of the highest level of development students are capable of taking

> …a position outside a particular context or frame of reference and look back on 'who' is asking the question, 'why' the question is asked at all, and 'how' answers are arrived at. They no longer dutifully try to come up with answers when questions are asked (p. 139).

They are willing to take risks and become personally engaged in the search for knowledge and understanding; in short to think critically.

But instead the approach of many college students to mathematics and statistics is a dualistic one. They tend to think that there is always one correct answer to a problem and that their job is to find out what that one right answer is, put that number down on a piece of paper with as little explanation as possible, give it to the professor, and expect to receive kudos for their heroic effort. They are thinking at the lowest level of cognitive development. It is part of the intrinsic identity of many students on entering college to think in these absolute, right or wrong terms and unfortunately many of them do not get beyond this in their one math or statistics course, even though they may do so in other college courses.

Also many students may have had success in their school level mathematics or statistics courses with the dualistic approach and the chance is that, if they have to change and think critically, since that is harder, they are afraid that they won't be as "successful" as before. And because this attitude is so deeply ingrained in the psyche it is difficult to change. It is difficult for these students to rise to another level of cognitive development, especially in their relation to statistics or mathematics. According to Turiel (1966), in investigating development on the Kohlberg model of moral development, "people did not change when in an environment more than one stage of development later than their own stage. But persons in an environment just one step beyond their current state moved toward their environment" (Turiel quoted in Copes, 1993, p.143). Other authors tend to agree that the optimal challenge occurs when instruction is based approximately one level above the students' present belief system. See for example, Kurfiss (1975). Thus this change in viewpoint occurs one stage at a time and takes time. Necessarily it is a gradual change.

Thus it is important to realize that this "stretching" of students in one semester may not work and if a student is stretched too far she may collapse from too much development too fast. In the case of the international travel lab component one must be aware of this potential danger and at the same time capitalize on the potential benefit. The potential benefit is that because of the radical change in context, the group coherence, and the relatively greater amount of freedom to define the work, students will rise to the occasion. Thus students in the context of such an academic endeavor in an international setting, will at the same time feel challenged and exhilarated as well as overwhelmed. The job of the trip leaders is to balance these two; to try to provide a degree of structure in a sea of insecurity. For what type of learning can occur in an atmosphere of total insecurity? For us in this context, it usually means a quick trip to the beach or a museum occasionally in order to recoup. It is easy to try to do too much each day. This is why the number of official encounters each day is limited to at most three. Also in the context of Nicaragua and Cuba the tropical heat is a factor which is not a consideration in a normal classroom setting. One's normal energy level is depleted more rapidly in such circumstances, which in turn influences the pace of effective learning.

In addition to these general works there are others that deal in particular with the influence of field studies in education at various levels. One by Hursh and Borzak found in *The Journal of Higher Education* (1979) suggests that in the reported situation researchers found that the students involved in these field studies developed to new levels of problem solving ability. They were thrust into the work environment where they had to learn, "all too painfully, that there is no one 'right' answer or that the 'system' cannot be bucked, that it is inherently complex and many-sided" (Hursh, 1979, p.71). The participants tended to abandon "dualistic (black/white) thinking in favor of multiplistic or relativistic thinking" (Hursh, 1979, p.70). Participants reported that they "had learned to take initiatives, to take responsibility for themselves, to be more autonomous and independent" (Hursh, 1979, p.72).

They also indicated "relating to professors more 'as equals' and behaving more informally than would be 'encouraged or proper' on campus" (Hursh, 1979, p.72). This partnering approach between faculty and students also occurs in the travel component. It must, because students and faculty are, in practical terms, living together as a group twenty-four hours a day for three weeks. In the case of the internships studied by Hursh and Borzak (1979), the term was a regular workday but over an eight-week period. Still the amount of time in context appears to be sufficient to make a difference in the relationship of faculty and students. It is also an important positive feature, which engenders the change students often experience. The learning process is different under these circumstances. In the normal campus setting, students may not come to class every day nor even communicate regularly with the professor.

In the setting of the travel lab there is a stronger sense of a joint effort; everyone depending on everyone else to get the work done. In fact, one of the major goals of the orientation during the semester prior to the actual travel is to insure that the participants become a well-bonded group. Without this group coherence one finds friction, animosity or even jealousy. The group coherence is not mindless group conformity as much as a group sense of mutual respect and recognition of the need to work together to accomplish mutual goals. And the degree to which this coherence is obtained determines in part the effectiveness of the learning process and generally the success of the trip.

Another aspect of the international travel lab is the way in which students adopt new roles in response to the new situation in which they find themselves. In the case of Hursh and Borzak (1979), the interns initially experienced an ambiguity regarding the role they were to play. They had to experiment with new and somewhat unfamiliar forms of behavior typical of adults in order to adjust to new circumstances. But as these authors also point out, in living with this discontinuity and ambiguity participants developed an attentiveness to new viewpoints. They were ready and open to the need to experiment with new behaviors in order to be able to function effectively in this new situation. In other words they were primed for learning. A similar situation occurs with the students in the travel lab component. In the beginning there is a high degree of tension and uncertainty about the process they have gotten themselves into. The role conflict is evident. They are not students anymore in the conventional sense. But actually because of this uncertainty, they begin to search for and find ways to insert themselves into this new setting. To the extent that they successfully achieve this they develop a new self-confidence and become more effective learners. They also may find they are moving to a new level of cognitive development.

Another important point grows out of the liberal arts. Agnes Scott College is a liberal arts college and most of our students understand what that means. So it is natural to think about what this means in the context of teaching elementary statistics. Students find it natural to write a paper in a history or literature course and be self-reflective. Somehow in statistics objectivity is the main principle. Or is it? Should we not be teaching our students to not only think clearly and logically but also to think about what it is they are thinking about and why? This self-reflection or self-knowledge is key to liberal learning. Does it not also include the area of statistics? Do we not also learn from asking why is it important to learn statistics? Not just what is it good for, but what is good and why do we care? So built into the course, and certainly built into the international travel lab component, is a questioning of why are we going abroad, why is the topic we are investigating important, and how does this change our view of the world?

Although rather obvious, the idea of an international travel lab component grows naturally out of the idea of a liberal arts college and in fact supports the College's goals and purposes. It is designed to nurture students to a higher level of inquiry and cognitive development through the challenge of surviving in a truly foreign environment and to find comfort in the knowledge that what they have learned in the classroom setting is sufficient when combined with their own creativity and native instincts. It is designed to encourage joint efforts bringing faculty and students closer together in a mutually respectful learning community while accomplishing an important task utilizing elementary statistics as a tool.

Finally it is important to note that women students are likely to respond well to this type of approach. Agnes Scott College is a college for women with a rich history of addressing the educational needs of its students. Belenky et al. (1986), Buerk (1981), and Kurfiss (1988) indicate that women students often react negatively to the dualistic and formulaic thinking so typical of elementary college courses in statistics and math courses. The preferred approach by many women seems to be one based on inference from the specific to the general. In other words, first consider the data and then, once such a concrete foundation is laid, go on to more general structures. Again the educational philosophy of the international travel lab component would be consistent with this view of how students learn.

EVALUATION

To evaluate the international travel lab component based on the limited experience thus far is difficult. However there is some data and some anecdotal evidence to relate. For the course in Nicaragua there were only nine students registered. (One became ill, so only eight went.) For the course to Cuba in May, 2002, twenty students have registered. Perhaps there is more interest in Cuba than Nicaragua, but clearly more students are responding to the idea. It was thought that students in the areas of math and science did not have many opportunities to participate in a College supported Global Connections course, so the travel lab would provide such an opportunity. However none of those on the Nicaragua trip were math or science majors. This was somewhat disappointing. On the contrary though, of the twenty who are registered for the Cuba trip, twelve are math or science majors (including Psychology), three are international relations/business majors, two are women's studies majors and one is a political science major. Most students understand the travel lab component to be an exercise in applied statistics certainly but in an interdisciplinary environment. Nevertheless it seems to be attracting an increasing number of math and science oriented students. Clearly this is not an identifiable trend as yet.

Student evaluations of the Nicaragua trip were uniformly good. What students seemed to appreciate the most were the real world context and the intense even unforgettable experience. It is not clear that these responses reflect the statistical nature of the course or the fact that the travel experience in itself was memorable. It is undeniable that the travel experience itself is a strong draw for the course, but there is not enough experience yet to sort this out. What is clear is that students do come away with the understanding that there is statistical work to be done in the real world, that they can identify statistical problems, and that they are familiar with some tools with which to address some of that work.

CONCLUSION

This paper has described the nature of an international travel lab for an elementary statistics course, the rationale underlying it and some evaluation of its effectiveness. Although Agnes Scott College is a liberal arts college for women, it is felt that many of the reasons for offering such an international travel lab are applicable at other undergraduate institutions as well. One major factor to consider is the cost of international travel and, happily for Agnes Scott students, the college does provide a grant of fifty percent of that cost. But many of the benefits described herein for the international travel lab may also occur in non-international settings. Although the thought of international travel does attract student interest, there does not appear to be any reason why such a lab could not be designed in a national or even regional setting.

REFERENCES

Belenky, M.F., Clinchy, B.M., Goldberger, N.R., & Tarule, J.M. (1986). *Women's ways of knowing: The development of self, voice, and mind.* New York: Basic Books.

Buerk, D. (1981). *Changing the conception of mathematical knowledge in intellectually able, math avoidant women.* Doctoral dissertation, SUNY Buffalo.

Copes, L. (1993). Mathematical orchards and the Perry development scheme. In A.M. White, (Ed.), *Essays in humanistic mathematics* (pp. 141-149). Washington, D.C.: The Mathematical Association of America.

Hursh, B.A., & L. Borzak. (1979). Toward cognitive development through field studies. *Journal of Higher Education, 50(1),* 63-78.

Kurfiss, J.G. (1975). *Late adolescent development: A structural-epistemological perspective.* Doctoral dissertation, University of Washington.

Kurfiss, J.G. (1988). *Critical thinking: Theory, research, practice, and possibilities*. ASHE-ERIC Higher Education Report No. 2 (pp. 51-89). Washington, D.C.: Association for the Study of Higher Education.

Moore, D.S. (2000). *The basic practice of statistics* (2nd edn). New York: W.H. Freeman and Company.

Perry, W.G., Jr. (1970). *Forms of intellectual and ethical development in the college years: A scheme.* New York: Holt, Rinehart & Winston.

Turiel, E. (1966). An experimental test of the dequentiality of developmental stages in the child's moral judgment. *Journal of Personality and Social Psychology, 3*, 611-618.