Market Survey Research: A model for ethnobotanical education

My LienThi Nguyen, Katherine T. Doherty and Julia Wieting

Education

Abstract

Ethnobiological imperatives in education and NSF initiatives for improving excellence in science, technology, engineering and mathematics (STEM) education for all students were addressed by the development of a research oriented, market survey ethnobotanical project developed with the involvement of undergraduate students. This market survey project presents a model for Ethnobiological and STEM education that is adaptable to educational institutions and communities world-wide. Collaboration among users of the model and synthesis of results would provide an international look at the biocomplexity of markets systems. Students gained experience in scientific research, including: observation and forming hypothesis, collection and analysis of data, and dissemination of results. Students practiced ethnobotanical research skills, including: developing and applying an informed consent statement, producing herbarium vouchers, interacting with cultural representatives. Survey materials and hypotheses were modified during the research period to maximize our efforts. Students co-authored with instructor two publications resulting from the research involvement. The instructor gained experience by involving students in research and application of the instructor's research to an undergraduate ethnobotanical project. Challenges are discussed, as well as recommendations synthesized from these experiences and from reviews of other student-research studies.

Introduction

In the 18th century, Carl Linnaeus dressed in traditional Lapp costume to lecture to his students on the ethnobotany of Lapland (Balick & Cox 1996).

From this earliest account of the teaching of plant use and cultures, consideration of the methods for education and training in ethnobotany has gained increasing popularity (Bartoo 1964, McClatchey *et al*. 1999) and concern (Bennett 2005, Hamilton *et al*. 2003, McClatchey 1999). In particular, the Intellectual Imperatives in Ethnobiology (IIE) (Salick *et al*. 2003) include developing educational models that have a strong local focus, teach multidisciplinary skills, and involve student participation in research experiences. These overlap with the National Science Foundation's (NSF) initiatives for improving excellence in science, technology, engineering and mathematics (STEM) education for all students. Students involved in cultural or localized science research projects have shown greater retention of knowledge, techniques, and quantitative skills (National Science Foundation 1997) than those who do not have such experiences. These research involvement opportunities also give students insight into contemporary problems of the area in which they have chosen to work (Jimenez *et al*. 2002).

These discussions provide important guidelines on how ethnobotanical education should progress. What we need now is more discussion of successful educational experiences as well as description of curricula, labs, projects, or syllabi that have been tried and tested (Crone 2000,

Correspondence

My Lien Thi Nguyen, Environmental Studies Program, Biology Department, Box 731, Vassar College, 124 Raymond Avenue, Poughkeepsie, NY 12604. U.S.A.
mylien.t.nguyen@gmail.com

Katherine T. Doherty, Department of Botany, University of Hawai`i, Honolulu, Hawai`i 96822. U.S.A.
Julia Wieting, Department of Anthropology, University of Hawai`i, Honolulu, Hawai`i, 96822. U.S.A.

Ethnobotany Research & Applications 6:087-092 (2008)

McClatchey 2002, Wagner 1997, 1998a, 1998b). To that end, we propose that market survey research is an ideal educational model to address the educational imperatives of both the IIE and the NSF. Markets are complex and rich sites for observing and questioning ethnobiological interactions with opportunities for qualitative and quantitative data collection (Bye & Linares 1983, Cunningham 2001). They are locally accessible field sites. Their proximity to educational institutions eliminates or reduces the expense of traveling to distant research sites. Locality is pertinent in that ethnobotanists are called to broaden their scope beyond "traditional" societies in remote locations (Bennett 2005) and to recognize the dynamic plant-people interactions occurring in urban centers (Balick *et al*. 2000). Such a model gives students an opportunity to be involved in addressing a local concern when applied to real community needs (Hamilton *et al*. 2003, Winn 1995). Furthermore, students with mobility difficulties would have opportunities to conduct fieldwork and fully be involved in the scientific process as these sites are often found in urban centers or other accessible areas (Nguyen 2006a).

In order to illustrate the efficacy of the market study as an educational tool, this paper describes a market survey and analysis which was developed as a project-based, student research involvement in an undergraduate ethnobotany course. This project was developed and carried out for Advanced Ethnobotany (BOT 440), a required course for the Bachelor of Science degree in Ethnobotany offered through the Ethnobotany Track of the Department of Botany at the University of Hawai'i at Manoa in Honolulu, Hawai'i.

Methods and Analysis

The market survey was a continuation of research the first author began as part of her study in the dynamics of food traditions and plant use by Vietnamese people in Hawai'i and Vietnam (Nguyen 2006b). For those not familiar with ethnic Hawai'i, the Vietnamese ethnic group is one example of the ethnic diversity of Hawai'i that in addition to Native Hawaiians, includes other Pacific Islanders, and people that identify as Black or African American, American Indian, Alaskan Native, Asian, Hispanic or Latino, White, or combinations with one or more other races (U.S. Census Bureau 2000). The market survey project in Chinatown, Honolulu was proposed to the students in lieu of a traditional lecture format course. The field site was chosen due to the advantages of urban, local markets, and because the first author had research experience and established rapport with vendors in the area. Pre-established research and rapport was a key issue in this project due to the short duration of a semester course. Conducting research projects where the instructor has applied the same or similar research design, can facilitate teaching and student involvement insofar as similar issues arise and are anticipated (Winn 1995). A consensus was reached between the instructor and two students that included hypotheses to be tested and co-authorship on papers resulting from the project.

The resulting project was a market survey and analysis of food plant richness between mainstream supermarkets and Chinatown markets in Honolulu (for details of research project see Nguyen *et al*. 2008). The survey was understood to be a "snapshot" of species richness observed in a one semester course. The survey would be to record the presence of all fresh food plants, including fresh fungi, which were sold in the same market areas. The research team carried out the surveys on Saturday and Sunday mornings during February and March 2006. Plant presence was recorded by hand using a checklist and hand-drawn maps of food bins and their locations. Local names, prices, and the plant part or "form" was recorded. Including plant form enabled us to record more than one presence of a single plant species if it was available as different parts or structures (e.g., banana blossom and banana fruit are two different presence recordings for *Musa* x *paradisiaca* L.). However, we did not record "processed" food plants (i.e., juiced, chopped or bagged quantities). Different cultivars of a single species were also recorded as separate presences; noting the cultivar names, at times a vernacular name, provided a view of the cultural characteristics of the markets.

A consent form was developed by the researchers and was presented to the market managers and vendors. The mainstream supermarkets were contacted by telephone or approached in person prior to the conducting the surveys. This was done due to the more formal nature of these markets. Markets were kept anonymous. Ensuring anonymity gained us universal consent, and was particularly useful where resistance was encountered by market managers or vendors in our recording of prices and taking photographs.

Microsoft Excel spreadsheets were used to electronically record and organize the data from the paper checklists. Presence or absence was recorded as 1's and 0's to enable us to transfer and analyze the data in different software programs. The spreadsheets were continually modified as new occurrences of food plants, cultivars, or forms were added. Pivot tables and charts generated through Excel were used for initial descriptive analysis of the data. These are convenient for summarizing the richness of taxa levels and plant forms of individual markets and between markets areas. Excel was also used to calculate and generate graphs of percentages of plant form. SPSS 12.0 was used for statistical analyses. The Community Analysis Package (CAP) was used for the vegetation analyses of the markets. While traditionally employed in ecological studies, using CAP for market surveys is ideal because markets have "ecological" levels similar to a "natural" vegetation community. For example, a Chinatown area is equal to a community, where the individual

market vendors make up the sites in the community, and the food plants sold by each vendor are the species present for that site. Within CAP, TWINSPAN analysis and Agglomerate Cluster Analysis were used to look for structure between the markets as groupings of similar markets based on the association of their food plants in relation to the other markets.

Results and Discussion

The ethnobotanical results of the survey are presented and discussed in a paper co-authored by the instructor and students (Nguyen *et al*. 2008). Here we discuss the results from the perspective of the educational application of the market survey project.

Through this involvement, the students gained scientific research skills in making observations and formulating hypotheses, collecting and analyzing data, and ethnobotanical research skills in developing and using informed consent forms, producing herbarium vouchers, and interacting with cultural representatives in the market areas. In evaluations of the course, students reported that having this real research experience, from applying data collection techniques and analysis to presenting the results, was valuable and rewarding. Students also reported satisfaction with the "local" project because it allowed them to become acquainted with their community and its resources.

The instructor gained experience in the challenges and rewards of bringing research into a classroom format and involving students in that research. Four important challenges are discussed below with suggestions for future applications:

1) Running a research project in the course of one semester

There is a great demand of time commitment in the data collection, entry into the computer, and analysis, and writing up the results. This can be difficult when students consider their schedule of classes and vacation periods. Thus, there is a need for detailed planning of the organization and extent of student participation. However, the nature of research makes this an area where all parties involved need to understand that flexibility is required. The second challenge describe below as, understanding statistical and analytical tools, is an extension of the challenge of a one semester research project. A brief review of literature that describes undergraduate research projects follows that description to address both of these challenges.

2) Understanding statistical and analytical tools

Should a market survey class require that students have statistics as a prerequisite? Or should reviews of the most common statistical and analytical tools be incorporated into the course syllabus? Student evaluations of this aspect of the course revealed that they would have wanted more opportunities to learn statistics and data analysis techniques. When students had gained better understanding of the tools and the results, they had greater satisfaction in their work. One student recommendation was to have data analysis work with practice data sets from the onset of the course. This is a crucial criterion to consider in planning a market survey course.

Recognizing their unique limitations in a semester long research project for ecology undergraduate students, McCleery *et al*. (2005) recommend keeping the skills and knowledge necessary to conduct the research simple and easy to understand. This is a good approach for beginning students where the sophistication of data collection and complexity of analysis can be increased as the students gain skills and confidence. With 41 years of research experience with undergraduates, Craig (1999) also stresses simple beginning research projects, recommending what he calls, "Avoid the Nobel Prize Syndrome."

3) Plant recognition

Attention should be placed on students learning how to recognize and record plants prior to conducting surveys. More common food plants are recognized (e.g., apples, oranges, lettuces) but this may not be the case in ethnic market areas. Many food plants are displayed with name signs in the mainstream markets, but in ethnic markets there are often none, or signs may only have the food plant's ethnic name and in the ethnic orthography. The students in this survey were introduced to plants in the Chinatown markets prior to the survey, and the instructor was present for questions during the earliest and most surveys. However, careful attention is still required to ensure that plants are recorded properly. Voucher collections would remedy this problem. However, due to budget limitations, class collections may not always be feasible. Alternatively, photographs could be taken. The use of digital cameras today makes this easily possible. In an ecology class research project, Fritz and Van Camp (2007) implemented a plant identification field guide that students accessed on tablet PC's that were simultaneously used in the field to record their data. A similar model could be followed for the market surveys with students using tablet PC's in the market-place to simultaneously input plant presence data and check the identity of unfamiliar plants.

4) Assessment should be carefully thought out

Our primary assessment tool was producing a publishable paper, along with class participation. While a publishable

paper is a key goal in conducting scientific research, this may not be the best assessment tool particularly where the paper is co-authored with the instructor. However, students did report that producing a publishable work of the project was important to them and gave them pride in the work. Others have included keeping a journal documenting how research time was spent, or producing a portfolio of work from the course.

The production of a portfolio by individual students may be a better assessment tool for this educational model, in particular when the market surveys are group projects. McMullan *et al*. (2003) describe the portfolio as a collection of evidence of the student's learning process and competence levels; with integral components being the student's reflection and analyses of their learning experiences and explicit guidelines from the instructor for portfolio construction. Kuisma (2007) points out that forms of assessment for group projects, such as the final paper and oral presentation, reflects the outcome of the group effort rather than the process of learning by individual students. After two years of implementation, Kuisma concluded that students enjoyed doing the portfolios and the lecturers gained insight into the students' process of learning, but included challenges in reliability and fairness of assessment when compared across the lecturers. Furthermore, as the market survey is a class project, alternative to traditional lectures, the use of portfolio assessments are more appropriate (Gülbahar & Tinmaz 2006). Roeker *et al*. (2007) implemented portfolios that span the last two years of the chemistry curriculum. Theirs' is a broad model that includes many components, from traditional laboratories and research papers, to the requirement of attending departmental seminars and making oral presentations. Applied to ethnobotanical market research, portfolios could include evidence and reflections from the student as they move through the scientific process in the research, a collection of plant specimens collected, a poster of the final project, and their form of giving back to the community or market where they conducted the research.

5) Dissemination of results

The dissemination of the results from this model for ethnobotanical education has been the co-authoring and presenting of two papers at institutional and international levels by the instructor and the students. Nguyen *et al*. (2008) describes the survey and this paper describes the educational model and outcome. It is important to note here that these papers were completed (including submitted, edited, and resubmitted) after the end of the course and the students' official commitment time to the course. These realities should be clearly addressed with an understanding of research and publication commitment at the onset of the course and or research project.

Seymore *et al*. (2004) found that this was common in faculty-student research projects at four liberal arts colleges with established summer research programs. The students in that study also report that this co-authorship experience was much more demanding than experiences of presenting posters or co-authorship with other students on group papers. Guterman's (2007) report on the findings of three large studies defining the most important characteristics of undergraduate research (those that correlate with increased confidence or a stronger desire for postgraduate studies) found that writing a final report about the research was not as important as co-authoring a paper that was submitted to a journal. However, Craig (1999) comments that publishing is facilitated by requiring well-written, comprehensive reports by the students of their work. When designing and developing the research projects, he keeps publication in mind and with the students understanding this goal, they take greater care in their work and writing. This may be a better approach rather than the outset of co-authoring, rather, discuss that a good project and good reporting can lead to a publication. Additionally, Craig acknowledges that he is the one to take responsibility of fixing many of the "loose ends" that occur in undergraduate research experiences. He points out, and we authors concur, that this commitment by faculty members is crucial to the completion and publication of projects.

Conclusions

It has been shown that intellectual imperatives in ethnobiological education and NSF initiatives were addressed with the development and implementation of a market survey research educational model. The intellectual merit of this model lies in its usability by ethnobotanical and undergraduate educators in the improvement of ethnobotanical and STEM undergraduate education.

This model has broader impacts in that it is adaptable by most educational institutions or communities wherever markets exist. This is highly relevant as the U.S. population includes more than 35 million foreign born residents and markets facilitate the understanding of their dynamic and diverse impact on food availability. And, because markets are universal in function, applying this model to international collaborations and data synthesis could provide insight into the biocomplexity of markets systems worldwide, especially for areas that have experienced large migrations of people and plants.

The first author will repeat this educational model again armed with the results and lessons learned from this experience. New challenges may be encountered with different localities, ethnic groups, and different and/or a larger group of students. A future paper will report on these new results and development of the model.

The description of this project is a contribution to the increasing dialogue of ethnobotanical education, especially

at the undergraduate level. Strong commitment to and organization of the project is necessary for success in learning and research, but the rewards of ethnobotanical project-based student research is well worth the effort for all parties involved.

Acknowledgements

We thank the graciousness and kindness of the mainstream supermarket and Chinatown market vendors for giving us consent to linger and gaze upon fresh food plants in their market aisles. We thank the kindness and advice on methodology and analysis from Drs. Kim Bridges, Han Lau, and Will McClatchey. We thank the critiques and suggestions from the anonymous reviewers and from the editor, Will McClatchey. We thank the College of Natural Sciences and the Department of Botany at the University of Hawai'i at Manoa for their generous support of the Ethnobotany Track and Bachelor of Science degree in Ethnobotany. Without that support, this course and project would not have been realized.

Literature Cited

Balick, M.J. & P.A. Cox. 1996. *Plants, People, and Culture: The science of ethnobotany*. W.H. Freeman, New York.

Balick, M.J., F. Kronenberg, A.L. Ososki, M. Reiff, A. Fugh-Berman, B. O'Connor, M. Roble, P. Lohr & D. Atha. 2000. Medicinal plants used by Latino healers for women's health conditions in New York City. *Economic Botany* 54:344-357.

Bartoo, H.V. 1964. A survey of college courses of economic botany. *Economic Botany* 18:291-310.

Bennett, B. 2005. Ethnobotany education, opportunities, and needs in the U.S. *Ethnobotany Research & Applications* 3:113-121.

Bye, R.A. & E. Linares. 1983. The role of plants found in the Mexican markets and their importance in ethnobotanical studies. *Journal of Ethnobiology* 3:1-13.

Craig, N.C. 1999. The joys and trials of doing research with undergraduates. *Journal of Chemical Education* 76:595-598.

Crone, W. 2000. Educational issues from Summer 2000: A tail of two cities. *Plants & People - Society for Economic Botany Newsletter* 14(Fall):6-7.

Cunningham, A.B. 2001. *Applied Ethnobotany: People, wild plant use and conservation*. Earthscan, London.

Fritz, B. & K. Van Camp. 2007. *Using Tablet PC Technology to Examine the Effect of an Invasive Species on Plant Diversity at the Vassar Farm*. Poster presented at the 5th Annual Teaching with Technology Forum, April 25, 2007. Vassar College, Poughkeepsie, New York.

Gülbahar, Y. & H. Tinmaz. 2006. Implementing Project-Based Learning And E-Portfolio Assessment In an Undergraduate Course. *Journal of Research on Technology in Education* 38:309.

Guterman, L. 2007. What Good Is Undergraduate Research, Anyway? *The Chronicle of Higher Education* 53(50): A.12.

Hamilton, A.C., P. Shengji, J. Kessy, A. A. Khan, S. Lagos-Witte & Z.K. Shinwari. 2003. The purposes and teaching of Applied Ethnobotany. *People and Plants working paper 11*. WWF, Godalming, United Kingdom.

Jimenez, M., R. Palomera & M. Toledo. 2002. Undergraduate research and Co-op education: A winning combination. Pp. S4C13- S4C17 in *32nd ASEE/IEEE Frontiers in Education Conference*. Boston, Massachusetts.

Kuisma, R. 2007. Portfolio assessment of an undergraduate group project. *Assessment and Evaluation in Higher Education* 32:557-569.

McClatchey, W. 1999. Suggested elements of Economic and Ethnobotany courses and programs of study. *Plants & People - Society for Economic Botany Newsletter* 13(Spring):5-7.

McClatchey, W. 2002. Teaching ethnobotany labs. *Plants & People - Society for Economic Botany Newsletter* 20(Fall):6, 11.

McClatchey, W., A. Paul, T. Flaster & V. McClatchey. 1999. An Evaluation of Educational Trends in Economic Botany. *Centre for International Ethnomedicinal Education and Research: Ethnobotany Educational Publication Series* 1:1-21.

McCleery, R.A., R.R. Lopez, L.A. Harveson, N.J. Silvy & R.D. Slack. 2005. Integrating on-campus wildlife research projects into the wildlife curriculum. *Wildlife Society Bulletin* 33:802-809.

McMullan, M., R. Endacott, M.A. Gray, M. Jasper, C.M. Miller, J. Scholes & C. Webb. 2003. Portfolios and assessment of competence: a review of the literature. *Journal of Advanced Nursing* 41:283-94.

National Science Foundation. 1997. *Shaping the Future, Volume II: Perspectives on Undergraduate Education in Science, Mathematics, Engineering, and Technology*. National Science Foundation, Arlington, VA. www.nsf.gov/pubs/1998/nsf98128/nsf98128.htm.

Nguyen, M.T. 2006a. Ethnobotany on a roll: Access to Vietnam. *The Review of Disability Studies* 2(2):37-46.

Nguyen, M.T. 2006b. Insertions and deletions: Evolution in the assemblage of Vietnamese food plants. *Ethnobotany Research and Applications* 4(1):176-201.

Nguyen, M.T., J. Wieting & K. L. Doherty. 2008. Vegetation analysis of urban ethnic markets shows mainstream market generalists and Chinatown ethnic-specialist vendors. *Ethnobotany Research and Applications* 6:63-85.

Roecker, L., J. Baltisberger, M. Saderholm, P. Smithson & L. Blair. 2007. A Science Portfolio. J*ournal of College Science Teaching* 36(4):36-44.

Salick, J., J. Alcorn, E. Anderson, C. Asa, W. Balee, M. Balick, S. Beckerman, B. Bennett, J. Caballero, G. Camilo, A.B. Cunningham, E. Elisabetsky, L. Emperaire, G. Estabrook, G. Fritz, L. Gross, E. Hunn, T. Johns, E. Luoga, G. Martin, W. McClatchey, J. Miller, P. Minnis, D. Moerman, M. Paletti, D. Pearsall, C. Ramirez-Sosa, J. Rashford, B. Schaal, D. Spooner, J. Stepp, M. Thomas, T. Ticktin, N. Turner & J. Xu. 2003. *Intellectual Imperatives in Ethnobiology: NSF Biocomplexity Workshop Report*. Edited by J. Salick, C. Asa, G. Camilo, G. J. Fritz and J. Miller. Missouri Botanical Garden, St. Louis, Missouri.

Seymour, E., A.-B. Hunter, S. L. Laursen, and T. DeAntoni. 2004. Establishing the benefits of research experience for undergraduates in the sciences: First findings from a three-year study. *Science Education* 88:493.

U.S. Census Bureau. 2000. *Census 2000 Data for the State of Hawaii*. U.S. Census Bureau. www.census.gov/census2000/states/hi.html. (Accessed January 6, 2008).

Wagner, G. 1997. Outline of class projects by teachers around the country. *Plants & People - Society for Economic Botany Newsletter* 11(Spring):2-3.

Wagner, G. 1998a. In the classroom: What is it? *Plants & People - Society for Economic Botany Newsletter* 12(Spring):19.

Wagner, G. 1998b. South Carolina home garden project. *Plants & People - Society for Economic Botany Newsletter* 12(Winter):9, 11.

Winn, S. 1995. Learning by Doing: teaching research methods through student participation in a commissioned research project. *Studies in Higher Education* 20(2):203-214.