A LAND USE PLANNING EXERCISE USING SOIL SURVEY REPORTS[1]

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Abstract

The course Soil Resources (SOIL/AGRO 153) at the University of Nebraska-Lincoln introduces soil survey reports in a land use planning class project. The project involves six activities: (1) selecting an appropriate land area based on projected use; (2) collecting data on land use capabilities from the soil survey report: (3) designing a detailed land use plan; (4) writing recommendations and rationales for the plan; (5) drawing a map showing locations allotted to each activity; and (6) making an oral presentation summarizing the plan. Student responses to a survey related to the activity did not differ between agriculture and natural resource majors regarding the importance of soil for crop production. Both groups of majors had increased regard for the importance of soil characteristics for urban planning. This regard decreased sharply by the end of the semester. The activity did not change either group's regard for the importance of soil characteristics for natural resource conservation. The activity enhances students' understanding of soil behavior by giving them first-hand experience in gathering and interpreting soil data. The activity enables students to relate soil concepts with concrete situations. The activity also results in change in students' appreciation of soil properties for making reliable land use decisions.

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Introduction

Years of instructional research and experience have shown that education must use active teaching methods and go beyond simple information transfer (Feldman and Paulsen, 1994; McKeachie, 1986; Myers and Jones, 1993; Palmer, 1998). A well-designed course can also successfully introduce and reinforce valuable career skills such as: (1) locating and selecting appropriate information for a specific task; (2) putting ideas on paper in written and graphic forms; and (3) presenting a concept orally.

We have developed an educational activity to introduce these skills to students and provide opportunities to apply them. In this paper, we describe and analyze the resulting activity. Although our subject matter is soil science, similar design or problem-solving opportunities are likely to exist in other disciplines.

Cooperative learning in the college classroom is being increasingly recognized as a major tool to improve student performance (Brackelsberg and Brackelsberg, 1998; Bull and Clausen, 2000; Murano and Knight, 1999). The challenge is to create learning opportunities which are effective, relevant to the learning objectives of the specific class, and can be performed within the confines of that class.

Introducing the soil survey report in a beginning soil science course can combine several worthwhile objectives. First, the textual, graphical, and tabular data in the reports can provide the raw material for an active learning exercise which can be tailored to the needs, time constraints, and resources of many different class environments. For example, Robinson and Schafer (1993) used information from soil survey reports in an introductory soil science class to produce both agricultural and urban land use plans. Lee et al. (1999) used online soil survey reports and

the STATSGO database to introduce soil survey principles. Last (1984) described similar efforts to provide soil science curriculum content to junior and senior high school teachers.

A second objective for using soil survey reports in an introductory soil science course is to broaden the acquaintance of the public, by educating students, with information contained in reports. Beatty and Lee (1972) stressed that traditional soil science courses do not serve land use planners well because of such courses' typical emphasis on soil fertility. While soil survey reports do provide information on cropping and tillage to traditional agricultural audiences, they are also useful, with proper training, for such applications as land valuation and construction (Anderson et al., 1982). Stevens (1966) described the improvement in locating a recreation area resulting from application of soil survey information. Such an application would be of great value to college natural resource majors in their post-graduation employment.

Finally, involvement of students in teacher education programs, beyond traditional agricultural education, could help extend soil science information into the K-12 system. This would help to alleviate what Van Meter and Santucci (1990) found to be a lack of awareness of soil science information by teachers in the social sciences and at the same time overcome the initial impression that the soil survey report is excessively technical (Bicki, 1991).

The objectives of this paper are to (1) describe a land use planning activity developed for an introductory soil science course which uses the soil survey report as its primary source material; and (2) evaluate that activity for its effect on student attitudes about the utility of soil science information for different purposes.

Description of the Activity

Soil Science/Agronomy 153 (Soil Resources) at the University of Nebraska-Lincoln is a highly interactive, small-group course (Sorensen et al.,1992). The course provides four hours per week of small group (15 to 20 students) activity time for cooperative learning activities. The exercise described here is typically used in the eighth or ninth week of a 15-week semester. At this point in the semester, the students have worked with basic soil properties (horizonation; parent materials; chemical, physical, and biological characteristics), and have received a very brief introduction to the soil survey report. The students have also been engaged in cooperative learning long enough to undertake a more involved group project successfully. The choice of a housing development for the exercise was intended to reinforce the importance of soil properties in an urban setting. This exercise is particularly appealing to students from majors such as horticulture or landscape design who might see an agriculturally-oriented soil science course as foreign to their future.

Prior to initiating the project, the instructors select one or more sections (259 ha or 640 A) of land from a published Nebraska soil survey report. The specific county and section are selected to provide appropriate challenge to the student-planners. The instructors have, for the present, decided to continue using conventional paper survey reports to minimize the reliance on possibly limited computer software and hardware. to acquaint students with reports in the most common current format, and to offer a state-oriented flavor to the activity. Others who have developed similar exercises have successfully used computerized soil survey information (Lee et al., 1999; Robinson and Schafer, 1993).

On the first day of the 3-day activity, the students are assigned to groups of 3 or 4, and provided with the relevant county soil survey report and a legal description of a 259 ha land area. Material in the students' course manuals describes the premise of the activity: The student group has been contracted by a development company to provide a preliminary site plan for a housing development to occupy a quarter of the area assigned (64 ha or 160 A). The group's "pay" (i.e., grade) on the plan will depend on how well they fit the requirements of the plan to the potential of the site. The instructors recommend that the students assume formal roles, such as group leader, writer, mapper, and reporter. Table 1 shows a complete list of the design requirements. The student-planners are given the option of deleting one or more of the required elements of the project but are advised that they will have to make a strong case to do so. Design elements not required may also be included at the students' option, consistent with the limitations of the site.

Continuing on the first day of the activity, the students make a tentative selection of 64 ha to use, then inventory the soils they must manage using the soil survey report. Properties of interest typically include slope, drainage characteristics, and texture. By the end of the first class period, the student-planners should have developed at least a tentative plan for the site, in the form of a rough map, supported by relevant data drawn from the soil survey report.

During the second 2-hour class period, the student-planners confirm or amend their initial choice, then proceed to develop it into a full-fledged plan. In most cases, the

student groups can complete their planning during this second period, but formal writing and map-making are usually done outside of class.

During the third 2-hour class period, the student-planners make oral presentations of their plans. The presentation usually consists of a 10 minute description of the plan followed by 5 minutes of questions from the "board of directors" of the development company, which consists of students from the other planning groups.

Grading of the project is based on a 100 point total possible score but basically is in three parts: the written report, the oral presentation, and a self-evaluation by the group members. The emphasis is on best use of soil properties for the development objectives, but credit is also given for creativity in the design. The written report is graded by the course instructors. The oral presentation is graded on an "A,B,C" basis by student evaluators (the "board of directors") and contributes a maximum of 15% to the final project grade. Finally, the members of each group are required to fill out a form grading themselves and the others of their group for their contribution to the group effort, also on an "A,B,C" basis. While this group evaluation counts 10% of the final project grade, members receive full credit if the evaluations are consistent for all members. Grades of individual group members may also be adjusted if the part of the project for which he or she is responsible is particularly well done or is substandard in some way.

Student Response

Student response to the exercise is almost uniformly positive. This is supported by a preliminary survey given in the 1996 academic year. Using a 9 point scale, in which 1 = very little and 9 = very much, student response to the question "How much use did you make of the soil survey in your decisions" ranged from 8 to 9. Student response to the question "To what extent do you think site selection should reflect soil properties" ranged from 7 to 9.

We administered a more quantitative student survey in the 1999-2000 academic year (Table 2). Besides basic demographic information, we asked three questions about students' attitudes with regard to soils for agricultural uses, urban uses, and natural resource planning. The class was divided into three approximately equal parts. One third was given the survey immediately before the land use planning

Table 1. Design requirements for land use planning project.

Moderately-priced single-family homes ($75,000 to $125,000) on 0.1 ha (0.25 A) lots.
Higher-priced single-family homes (greater than $125,000) on 0.2 ha (0.5 A) lots.
Higher density apartment or condominium development.
Access road(s) of 4 lanes entering the development.
Residential streets of 2 lanes.
Shopping area (small, uncovered strip mall type, 10 stores or so).
Business park (2 story office buildings).
Elementary school and playground.
Family park (grassy area, playground equipment, picnic facilities).
Nature area.
Drinking water well (assume that water is available in sufficient quantity and quality anywhere on the site).
Sewage treatment facility.
Green space (used as a buffer to separate housing sites from commercial developments and other incompatible land uses).
Small pond or lake (required for flood control).

Table 2. Evaluation instrument for student attitudes related to land use planning project.

Please circle the response on the following questions that best fits you:

1. My class year is 1. freshman; 2. sophomore; 3. junior; 4. senior; 5. grad or other.

2. I am a Nebraska resident for purposes of UNL tuition. 1. yes 2. no

3. My place of residence is 1. rural or unincorporated
   2. incorporated less that 1000 population
   3. incorporated from 1001 to 5000 population
   4. incorporated from 5001 to 25,000 population
   5. incorporated from 25,001 to 100,000 population
   6. incorporated over 100,000 population

4. My major is (please fill in major name or "undecided") _____

Please circle the answer that best matches your response to the following questions using the scale
1 = strongly agree
2 = agree
3 = neither agree nor disagree
4 = disagree
5 = strongly disagree

5. An understanding of soil characteristics in important for crop production.

1 2 3 4 5

6. An understanding of soil characteristics is important for urban planning.

1 2 3 4 5

7. An understanding of soil characteristics is important for natural resource conservation.

1 2 3 4 5

activity (labeled "Pre-activity"); one third immediately after the activity ("Immediate post-activity"); and one third at the end of the semester, about 4 weeks after the activity ("Late post-activity"). The student responses were number coded and analyzed using the chi-square procedure (SAS Institute, 1990).

Results of the survey showed that the three survey groups were relatively homogeneous with regard to demographics (results not shown). Only distribution of majors (i.e., agriculture vs. natural resources) differed with time of survey administration in that there were fewer natural resources majors in the Pre-activity group, so analysis was conducted on the data subdivided by major.

We found no differences over time for either agriculture or natural resources majors with regard to the first survey statement ("An understanding of soil properties is important for crop production"), although the data nearly met the 5% significance level ($P = 0.054$ for both majors) (Table 3). For agriculture majors, there was a general trend of stronger positive responses with time. This was surprising because crop production was not the focus of the activity. We infer a general increase in regard for knowledge about soils throughout the semester, unrelated to the land use planning activity. For natural resources majors, strength of responses decreased with time, then increased, but sample numbers were very low, suggesting the variability was simply random. Alternatively, the activity may have had the inadvertent effect of diminishing the perceived importance of soil for crop production to a group who may have tended to that conclusion anyway.

Table 3 . Student responses to survey statements on importance of soil for different purposes, as a function of time of survey administration and academic major (percent of responses with number of responses in parentheses).

Time of Survey Administration	Statement[z]											
	Soil and Crop Production				Soil and Urban Planning				Soil and Natural Resource Conservation			
	Ag major[y]		NR major		Ag major		NR major		Ag major		NR major	
	SA[x]	other	SA	other	SA	other	SA	other	SA	other	SA	other
Pre-activity	56[w] (18)	44 (14)	100 (3)	0 (0)	28 (9)	72 (23)	67 (2)	33 (1)	62 (20)	38 (12)	67 (2)	33 (1)
Immediate post-activity	69 (18)	31 (8)	62 (5)	38 (3)	73 (19)	27 (7)	75 (6)	25 (2)	58 (15)	42 (11)	75 (6)	25 (2)
Late post-activity	72 (23)	28 (19)	83 (5)	17 (1)	44 (14)	56 (18)	33 (2)	67 (4)	50 (12)	50 (12)	50 (3)	50 (3)
chi square P	0.054		0.054		0.001		0.022		0.212		0.243	

[z] See Table 2, items 5, 6, and 7 for complete text of survey statements.

[y] "Ag major" is any major leading to a B.S. in Agriculture, "NR major" is any major leading to a B.S. in Natural Resources, both at the University of Nebraska-Lincoln.

[x] "SA" = Strongly Agree, "other" = any other response.

[w] Percentages for any combination of Time of Survey Administration Statement and Major (e.g., Pre-activity - Soil and Crop Production - Ag major) sum to 100%.

With regard to the second survey statement ("An understanding of soil characteristics is important for urban planning") we found a difference with time for both agriculture and natural resources majors (Table 3). For both groups, strength of response increased from Pre-activity to Immediate post-activity, then decreased to Late post-activity. This suggests that the activity did have the desired effect of increasing the appreciation of students for soil as an element in urban planning, but that the effect was short-lived, and diminished appreciably in only 4 weeks. The drop-off for natural resources majors is particularly sharp (Strongly Agree responses: 67% for Pre-activity; 75% for Immediate post-activity; 33% for Late post-activity), but sample numbers are again low, so we suspect that the exact percent change is not meaningful. Also, as there were no natural resource majors responding lower than "agree" to this statement at any time, we are less concerned by the exact percent responses. We are, on the other hand, concerned that the trend for strength of student responses degrades with time. This suggests that the central thrust of the activity, that soil properties do have a place in urban planning, needs further reinforcement during the semester.

Even though the activity does not deal with natural resource conservation explicitly, we had hoped that there would be a "bleed-over" of student attitude from the activity. There was, however, no change in student attitudes with time as measured by responses to the statement "An understanding of soil characteristics is important for natural resource conservation" (Table 3). This was true for both agriculture and natural resources majors. Nevertheless, most student responses were "Strongly agree", with natural resources majors giving generally more positive responses than agriculture majors. This difference between majors was not statistically significant when all survey administration times were combined, however ($P = 0.286$).

Evaluation

The activity described here was designed to address the three skill areas listed in the introduction. The following components correspond to those areas. (1) The soil survey report, textbook, and other materials available to the student contain voluminous amounts of information. Each student group needs to select from these sources the type of information they will need. (2) The written project and the development map provide opportunities for using written and graphical skills. Idea-sharing in the group leads to improvement of both. (3) The preparation for the oral presentation by each group and the process of observing and rating the presentation of other groups should help improve oral presentation skills.

The land use planning exercise described here successfully promotes several broader objectives as well. First, it immerses the students in the use of the soil survey report in a way that a simple "fill in the blank" type of activity would not. The students learn the value of the soil survey report in the context of a complex problem-solving activity which will be a part of the post-graduation employment of many of them.

A second objective of the activity is related to the first. For many students, taking courses outside of their immediate area simply represents another requirement, a hoop to jump through on the way to a degree. Soil Resources attempts to provide connections to the students' past, present, and future. The land use planning exercise described here provides many such connections, compelling the students to deal with soil limitations which will be very real for them as homeowners and taxpayers.

Finally, the format of the activity reinforces the cooperative, group-oriented style of the course. A mixture of student styles and skills results in a product that would not have been possible from one person working in isolation. This approach mimics trends in the business world, so that students who have had experience with group project activities while they are pursuing their education will be better positioned for success following graduation.

The text of the activity is available on the first author's web site (http://agronomy.unl.edu/fac/nmccall.htm).

Literature Cited

Anderson, J.L., R.L. Skarie, and B.A. Adams. 1982. Use of soil survey information by farm and nonfarm groups on three Minnesota counties. Jour. Soil Water Conserv. 37:178-181.

Beatty, M.T. and G.B. Lee. 1972. Relating soil science teaching to land use planning. Jour. Agron. Educ. 1:61-64.

Bicki, Thomas J. 1991. Promoting the use of soil survey through the use of improved delivery systems. Jour. Agron. Educ. 20:43-46.

Brackelsberg, Paul O. and Phyllis J. Brackelsberg. 1998. Experiences with peer review of term projects in undergraduate animal science and textiles and clothing classes. NACTA Jour. 42:32-34.

Bull, N.H. and F.C. Clausen. 2000. Structured group learning in undergraduate and graduate courses. Jour. Nat. Resour. Life Sci. Educ. 29:46-50.

Feldman, Kenneth A. and Michael B. Paulsen (ed.). 1994. Teaching and learning in the college classroom. Needham Heights, MA: Ginn Press.

Last, Donald. 1984. Soil surveys in the classroom. Jour. Soil Water Conserv. 39:30-31.
Lee, B.D.. J.A. Wald, and L.J. Lund. 1999. Introducing students to online county soil surveys and the STATSGO database using GIS. Jour. Nat. Resour. Life Sci. Educ. 28:93-96.
McKeachie, Wilbert. 1986. Teaching and learning in the college classroom: A review of the research literature. NCRIPTAL. Ann Arbor, MI: The University of Michigan.
Myers, Chet and Thomas B. Jones. 1993. Promoting active learning. San Francisco, CA: Jossey-Bass, Inc.
Murano, Peter S. and Timothy D. Knight. 1999. Introducing a cooperative learning term project into an introductory food science course. NACTA Jour. 43:21-25.
Palmer, Parker J. 1998. The courage to teach. San Francisco, CA: Jossey-Bass, Inc.
Robinson, C.A. and J. Schafer. 1993. An integrated learning project in introductory soils. Jour. Nat. Resour. Life Sci. Educ. 22:107-110.
SAS Institute. 1990. User's guide: Statistics. Version 6. Cary, NC: SAS Inst.
Sorensen, R.C., J.P. Lunde, B.K. Dierberger, and D.L. McCallister. 1992. Cooperative learning in an introductory course. NACTA Jour. 36(1):30, 33-34.
Stevens, Mervin E. 1966. Soil surveys as applied to recreation site planning. Jour. For. 64:314-316.
Van Meter, Donald E. and Georgette Santucci. 1990. Use of soil survey reports by secondary school educators in Indiana. Jour. Agron. Educ. 19:29-32.

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