

1996

# Innovative Teaching Strategies in a Large, Introductory Level Geology Class at the University of Nebraska-Lincoln

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Kaplan, Sanford S., "Innovative Teaching Strategies in a Large, Introductory Level Geology Class at the University of Nebraska-Lincoln" (1996). *Transactions of the Nebraska Academy of Sciences and Affiliated Societies*. 84.  
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**INNOVATIVE TEACHING STRATEGIES IN A LARGE, INTRODUCTORY LEVEL  
GEOLOGY CLASS AT THE UNIVERSITY OF NEBRASKA-LINCOLN**

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**ABSTRACT**

During the Spring Semester of 1995–96, a large introductory-level geology class, *Life of the Past*, was re-structured from a traditional lecture format into a format that incorporated journaling, group work, cooperative learning, group presentations, self-assessment, and lectures. Some minor adjustments were made at the half-way point because of suggestions made on mid-semester evaluations. Based on a questionnaire distributed to randomly-selected former students, the overall class performance, and the final class evaluation, the new format was judged highly successful.

† † †

Many of today's undergraduate students—including science and non-science majors, pre-service teachers, and non-traditional students—come to school with a poor understanding of science. Although some reforms are underway, science as presently taught at the middle and high school level frequently alienates students from science, with the result that undergraduate students, even those desirous of majoring in a scientific discipline, are poorly prepared to understand many basic scientific precepts. Even at the secondary-school level, emphasis seems to be placed on maximizing student exposure to vocabulary and facts rather than examining the broad concepts of science. Oftentimes, high school teachers do this in an effort, they believe, to prepare their students adequately for college-level classes. Beardsley (1992) states that there is “a widespread conviction that pre-college mathematics and science education in the U. S. is in such a grim state that radical reforms are urgent.” For example, biology is a common course offering in many high schools across the U. S. Leary (1990) reports that the National Research Council has found that “Biology is so poorly taught that the experience seems designed to snuff out interest.”

Beardsley (1992) reports that the number of students between grades 4 and 12 answering “no” to the question “Do you like science?” increases between these grades from 20 to 35 percent. As a result of these fact-oriented exposures to science in primary and secondary schools, undergraduate students come to college with no real understanding of the process of science, poorly prepared to participate in science classes, and with an attitude that the experience will be inevitably painful. They know from experience that science (1) is full of disjointed facts, (2) contains a difficult-to-understand jargon combined with over-dependence on complicated mathematics, and, most threateningly, (3) lacks a mission: that all the good science has already been done and there is little more to find out about the world around us. Most importantly, undergraduate students do not view science as a process and have a poor understanding of what separates science from non-science.

Students—including science and non-science majors, and many pre-service teachers—often graduate from college without a knowledge of what science is, how it operates, what it constitutes, and how it affects modern civilization. Even if they successfully navigate their way through existing introductory-level science classes, many students graduating from our colleges today are, at best, fact-rich but concept-poor (AAAS, 1989). Pool (1990) neatly summarizes the end-result of many introductory-level college science classes by stating that “Introductory courses may give majors everything they need to continue on to more advanced classes, but a student who is only going to take a physics (or chemistry or biology or geology) course needs both much less and much more.” Geology 105—“*Life of the Past*” (LOP), an introductory-level science course at the University of Nebraska–Lincoln (UNL)—has been taught over the last several years as a traditional, lecture-only style course typical of this genre. My objective for the

course was to cover the course texts (Richard Cowen, *History of Life*, 1995 and Stephen Jay Gould, *Wonderful Life*, 1989) completely and present as much content as possible.

Two events significantly impacted my decision to implement some innovative teaching strategies in the Spring, 1995–96 LOP class. In chronological order, they were my participation in a workshop concerned with training pre-service science teachers, and my role as Project Coordinator for the SEER Water Project.

### **The Enhancing Science/Mathematics Courses for Pre-Service Teachers Workshop**

As a teacher of one of the classes (LOP) frequently taken by pre-service science teachers enrolled at UNL, I was invited to participate in a workshop concerned with their education conducted in June, 1995. The workshop was sponsored by the Center for Science, Math, and Computer Education at UNL and supported by the Howard Hughes Medical Institute Biological Sciences grant. The workshop focused on issues of examining current course offerings at UNL and other schools aimed at pre-service science teachers, evaluating how these courses assess learning, and incorporating some innovative teaching strategies in presenting these classes. Interestingly, the workshop itself involved numerous work-sessions in which the participants evaluated issues using the pedagogical techniques we were examining in the workshop.

### **The SEER Water Project**

In January, 1995, I became the Project Coordinator for the Satellite Education and Environmental Research (SEER) Water Project. The SEER Water Project consisted of a series of 15 weekly, 2 hour Tuesday broadcasts televised via satellite to 15 downlink sites across Nebraska during Fall, 1995. The downlink site groups ranged in size from 3 to 12 teachers, and included a mix of large urban and suburban schools, and several small, rural schools with total student enrollments (K–12) of less than 350 students. Using the theme of “water,” each broadcast included the following elements:

- providing new science content in the areas of biology, chemistry, and geology,
- encouraging the incorporation of scientific research into schools across Nebraska,
- introducing teachers to new pedagogical models, including cooperative learning, group work, journaling, and the use of computer technology,
- illustrating the relationship between science and public policy, and
- examining the cultural and multicultural issues with regard to water practices.

### **CREATING CHANGE IN LIFE OF THE PAST**

In order to ascertain the changes, if any, in student learning as a result of revisions in course structure, some control data against which to compare the results of the “experiment” were needed. This was lacking; I had never previously envisioned revising my LOP class in this way and had never systematically evaluated the pedagogical style of the previous classes I had offered. Most importantly, I had no data on what students learned in my classes. Students at UNL are asked to fill out course evaluation forms at the end of each semester, but many students choose not to do so, and of those who do, many address issues related to the professor’s expertise, style, and class management. A questionnaire distributed to randomly selected, former students requested answers to 4 items: (1) to list some things/concepts they remembered from class and to indicate how long it has been since they were in my class, (2) to describe any controversial issues that were considered in their LOP class, (3) to mention some ways in which they thought the class could be improved, and (4) other comments were solicited. Those who filled out the questionnaire were also asked some basic information, such as their names, addresses, and a contact phone number.

Analysis of the responses to the questionnaires revealed some surprising results. I had been convinced that I was managing to communicate to students some key ideas, including the concepts of evolution, science versus non-science, geologic time, and the role of geologic history in interpreting past life. I was surprised to discover that of the 12 responses received, only six mentioned evolution as an important thing/concept remembered. Similarly, only four respondents mentioned geologic time, two mentioned extinction, and three mentioned changes in life over geologic time. Several students did not remember much: After reading one questionnaire given to me by a student, I asked him if the concept of evolution stuck with him at all, and his response was “not much.” Another respondent stated that he “didn’t remember very much.” Table 1 provides a summary of the data provided by the questionnaires filled out by previous students in my LOP class.

Also surprising were the responses to the next question, which asked students “What were the controversial issues you considered in class, if any?” Several students reported “none,” or “can’t remember any off-hand.” Several mentioned some appropriate topics, including the big bang theory, the concept of evolution, and the “distinction” (*sic*) of the dinosaurs. Reading the questionnaires suggested that in some cases students were familiar with some key issues in LOP, while the course had limited impact on others. Perhaps students were asked to remember too many things, and the key

Table 1. Results of background questionnaire

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1. After _____ years, list some things/concepts that you remember:	
DNA	Evolution of plants/animals
Extinction	Geologic time (age of the earth)
Plate tectonics	Fossil evidence for plate tectonics
Atmospheric changes	Life began in water
Pangaea I and II	Linnaean classification scheme
Dinosaurs	Climate change over geologic time
Burgess shale	“Life began as clay” theory
Don't remember much	
2. What were the controversial issues you considered in class, if any?	
Mass extinctions	Evolution
First living organisms	Origin of earth and planets
Big Bang theory	Evolution of humans
Don't remember any	
3. Can you think of ways you would have improved the class?	
Slides/pictures	Provide more handouts
Field trips	Museum tour
Smaller class size	
4. Other Comments:	
Good use of <i>Far Side</i> cartoons	
Have class on a different night	
Enjoyed the class	
Fun	
Questions in class were always welcome	

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concepts were being diluted with lots of interesting, but not highly important, information. This, to me, is the crux of the matter: If LOP is supposed to be an introductory-level science class for, primarily, non-science majors and pre-service teachers, what do the students need to get out of this class?

The SEER Program suggested to its participants that students can be expected to remember four, or at most five, key concepts or ideas. Deciding what these ideas are is an intensive and challenging task. A phrase frequently heard at SEER Project script-preparation meetings was “less is more.” The underlying importance of this concept is that if students are asked to remember less, but the “less” includes the distillation of several truly important ideas, they will come away from a class with more: they will be able to use the ideas they have more thoroughly learned in an appropriate manner both in later courses and in their future lives. The ideas selected for emphasis in the Spring 1995–96 LOP class included: (1) What is science, and how is it different from other world-views? (science versus non-science), (2) the theory of evolution, (3) geologic time, (4) extinction, and (5) how different sciences interact to answer important questions.

### THE REVISED STRUCTURE OF LOP—SPRING SEMESTER, 1995–96

Instead of a traditional lecture format, the revised LOP class included the following elements: (1) journaling, (2) group work, (3) cooperative learning, (4) self-assessment, (5) lectures, and (6) traditional assessment-by-exam. These course elements were worked into a three hour time block on Thursday evenings. Enrollment in the Spring 1995–96 LOP class was initially 70 students, which was reduced to 66 students at the semester end due to normal attrition and late registration. When LOP is offered in the Fall semester, it may attract up to 190 students in the Bessey Hall auditorium.

#### Journaling

Journaling was an important technique used in the class. Students were given a question at the end of class and were asked to respond to it in their journals sometime before the next class. Journaling was to be conducted via e-mail, and it was interesting to discover on the first night of class that of the 70 students in the class, over 50% had never used e-mail before, and that nearly 35% had never used a computer to any great extent. A brief “how to use e-mail” course was set up in

a computer lab for the first night of class in anticipation of this problem. Arranging the e-mail class turned out to be valuable. Many students who said they were somewhat familiar with e-mail were asked to help those who were not familiar with it at all and in the process sharpened their own e-mail skills. Only 15% of the class reported any real familiarity with e-mail on the first night of class. One of the most interesting comments I received back from students came from one of the them (not one of my assigned journaling partners) who e-mailed directly to thank me for making him learn how to use e-mail!

Once students sent in their e-mail responses to the journal questions, they would receive a reply discussing their entries. From a teaching perspective, the biggest drawback to this was the amount of time it would take to respond to  $\pm 70$  e-mail journal entries per week. Good fortune provided a solution to this problem in the week before class in January, 1996. Two former LOP students requiring several more geology credits enrolled in a Geology 299 (undergraduate research) class under my supervision, and their research focused on how journaling and student presentations impacted student learning in the new course structure. They presented their results at the 1996 Undergraduate Research Symposium at UNL.

### **Group work and cooperative learning**

Another task accomplished during the first night of class was to arrange the students in groups. Group work and cooperative learning were going to be important elements in the class structure, and since the class met only one night per week, getting the groups established early was critical. Groups were randomly arranged based on students' birth dates on the first night of class. We settled finally on 18 groups recognizing that some groups would have three people in them and others would have four. Groups were asked to decorate (over the course of the semester) the folders they were given in any way they chose; some of their creations were quite elaborate and artistic. The folders were used to receive and return papers, provide topics lists for each class meeting, and provide storage for some reference papers the students might want to use during the class.

For the purposes of this LOP class, "group work" was defined as those assignments in which groups were asked to work together to answer a question with, usually, one "correct" response. These items could be found in their notes or supporting text materials, or the students could discover the answer for themselves by considering the possible answers and selecting the most appropriate response. "Cooperative learning" involved questions in which more than one right answer exists; these questions tended to be more general and empha-

sized considering some of the controversial ideas presented in the class to which there is no right answer. Each class night, the students were provided, via their group folders, a list of topics for that night. These questions would be assigned during the class and considered during either group work or cooperative learning periods. In general, the group work and cooperative learning activities followed models discussed in Foster (1993) and Math Vantage (1996).

On occasion, groups were requested to turn in their group work notes for evaluation. These notes would be evaluated and returned to them via their group folders. Group work time was also meant to provide students with a few-minute break during the class. An important part of the group work process was "reporting out," in which a student presented the results of his/her group deliberations to the entire class.

### **Group presentations**

Each group was assigned a topic for which they had to prepare and present a group presentation on an assigned class meeting night. The first night of class the students viewed videotapes of several presentations prepared by teachers in the SEER Program. The students were told that these presentations were models, but their group's creativity would be an important element in a successful presentation. The list of presentation topics was prepared prior to the first class meeting, and groups were assigned their topics randomly at the end of the e-mail training session in the computer lab. The topics were keyed to the course syllabus and were designed to amplify or present new information not provided in the reduced lecture.

Another important aspect of the group presentations was that the class—by groups—would evaluate each presentation. Each group was provided an evaluation form to be filled out during or after a group presentation in which they assessed the quality of the presentation. These forms were to be returned in their group folders, and were then averaged together to come up with a grade for each presentation. The forms, once tallied, were provided to the presenting group being evaluated in their folder the following week. Comments were solicited on the evaluation form and space was provided for their inclusion.

### **Self-assessment**

Groups were provided a preliminary self-assessment rubric the first night of class. They were requested to consider the rubric and provide any desired changes/additions/deletions by returning their form to me via their group folders during course week 6. After the editing process, the rubrics would be provided to each student who would then complete a self-assessment and get it back to me during week 14.

## Lecture

In the traditional lecture format, students would sit through a three-hour lecture, with usually 2–3 breaks provided at convenient moments in the presentation. In the new class structure, lecture would be reduced to only 45–50 minutes out of a total 180-minute class. The lecture would usually be presented near the start of class, and the group work, cooperative learning, and student presentations would follow the initial lecture. It was also initially planned to provide a few minutes at the end of class for a closing lecture in which I would have the opportunity to wrap-up, or bring closure to the class activities for the evening.

## Assessment

One of the hardest parts of this entire process—for me—was revising my method of assessing student performance in the class. In the traditional lecture format, assessment was a relatively simple affair and consisted of giving the students a series of quizzes and hourly exams culminating in a final. For the last several classes I have offered the students the opportunity to help write questions for the hourly exams. The questions they submitted (without answers provided) would be bound in a packet which would then be placed on reserve in the library the week before a given exam date. The students could go to the library and study the questions they would be seeing on the exam. The packet would also contain some of my own questions, and the total number of questions in the packet would far exceed the number appearing on the exam. Students who submitted questions would receive extra credit, and students who had questions accepted for inclusion on the exam would receive some additional extra credit for each question they had selected.

With the revision of class structure, the role of the exams in assessing student performance was, like the lecture, reduced in emphasis. Tests of various types (including the final exam) would now count for only 44% of the students' grades. Tests would consist of 11 readings quizzes (short, multiple-choice tests covering the highlights of a given week's reading assignment, worth one point), 2 hourly exams (multiple-choice tests, worth 10 points each), and a final exam (a multiple-choice test worth 13 points). There would be no readings quizzes the first and last night of class, or those nights on which hourly exams were to be given. I have found readings quizzes to be a useful tool for helping students remember to look at the text before coming to class. I was concerned that the group work would never achieve its goal if some students in a group were totally unprepared to discuss the topics provided for that evening and therefore decided to retain this assessment tool in my new course structure.

In addition to the assessment points outlined on

Table 2. Student assessment in Life of the Past, Spring Semester, 1995–96.

Self assessment	25
Group work	13
Group presentation	18
Reading quizzes	11
Hourlies	20
Final	13
<b>Total:</b>	<b>100</b>

the syllabus, students would be provided the opportunity to earn some extra credit points over the course of the semester. These extra credit points would be given for submitting questions for the hourly exams (on a group basis), visiting the State Museum (natural history), bringing in a current news clipping pertaining to some aspect of LOP, or the like. The final breakdown of assessment points in the restructured LOP class is indicated in Table 2.

## THE MID-SEMESTER EVALUATION

Students in the class were asked to evaluate the course approximately half-way through the semester. Class size had stabilized at 66 students. Of these 66 students, 39 returned evaluations. Table 3 lists the questions asked in the questionnaire and provides some grouped responses to the questions asked. It is important to note that the totals provided for each question may include more than one response per student since several students wrote more than one comment in response to a question; if this was the case, all their responses were recorded and tallied. The total number of comments recorded for each question may therefore total more than 39. What really impressed me initially was the response to the evaluation. The students, by and large, took the time to write detailed answers to the questions. They were obviously involved in the process, and were interested in helping me determine the success and/or problems associated with the new class format.

Several interesting patterns emerged in a review of the evaluations which led to some modifications in the course format. A common thread in many of the evaluations was that the class size was too large. There is little that can be done about that in a university setting: the Spring LOP class is actually one of the smaller introductory-level courses offered by the Geology Department. Many respondents felt that the existing "reporting out" process took too much class time. As a result, during the second half of the semester I reduced the amount of reporting out by having groups initially work through a discussion topic and then coalesce in larger groups to compare their notes with other groups. One spokesperson would then speak for the larger group,



Table 3. Mid-semester course evaluation results. 39 student evaluations received out of 66 enrolled students in the class. Totals may add up to more than 100% (39) due to multiple responses on some evaluation questionnaires.

1. What are you learning in this class?	
Quite a bit	6
Stephen J. Gould— <i>Wonderful Life</i>	5
Origins of life	8
Evolution	10
Biology/geology connections	4
How to e-mail/use WWW	3
Geology/geologic time periods	2
Very little	2
Nothing	1
Scientific thought process	2
<b>Total:</b>	<b>43</b>
Several comments relating to class management were also provided in response to this question. They are:	
Class moves too fast	3
Textbook is too hard	1
2. Compared to other classes I have taken at UNL, I rate this class...	
One of the best courses/best intro courses I have taken	4
Excellent, outstanding, pretty cool, better than I thought	11
Unique	2
Average/good	5/4
Mediocre, difficult, confusing, not very good	6
Intense/involved	4
High energy	1
Chaotic	2
Do not like reporting out	1
Has potential	1
<b>Total:</b>	<b>41</b>
3. What do you think about the group work that we are doing? Is it helping you learn material?	
Helps	16
Does not help	2
Need better system of sharing answers	12
Frustrating	1
Too large a class for group work	3
Chaotic/noisy	1
Helps a student understand material	1
Not spending enough time in groups	2
Individual groups <i>learn</i> material	4
<b>Total:</b>	<b>42</b>

Table 3. Continued.

4. The lectures are worthwhile/not worthwhile. Why?	
Worthwhile	32
Too short	4
Enthusiastic, teacher loves material, coherent, clear, entertaining, great style	12
Best part of class	1
Hard-to-follow, too broad, goes off on tangents, confusing, too fast	6
<b>Total:</b>	<b>55</b>
5. Do you like the Group Presentations?	
Like	25
Fun	4
OK	3
No	5
Pain-in-the-butt	1
Useful learning tool	1
All look the same	3
Best part of the class	1
<b>Total:</b>	<b>43</b>
6. What would you do to improve the course?	
Eliminate some group work	3
More lecture	4
Reduce the size of the class	4
<b>Total:</b>	<b>11</b>

reducing the amount of reporting out by approximately 75% (4 versus 18 oral reports). I realized also that although I had intended to provide a closing lecture which brought closure to each class, it was never happening. The reporting out and the student presentations were taking so much class time that there was no way to provide closure at the end of the class period. I resolved to keep a stricter control on time in the classroom and make sure that the reporting out allowed enough time in the class for the student presentations and a closing lecture. One student (probably a pre-service teacher) also commented that I was not providing enough "wait time" between my asking the class a question and going on to answer it myself. This student referred to "wait time" as "that painful pause between a question to the class and the class' response." I incorporated this additional "wait time" into my lectures and was surprised to see that if I waited long enough, the class would answer my questions. Other students commented that they enjoyed not being treated like high school students in the LOP class. I found this comment very interesting. Having participated in the SEER Project and worked with many K-12 teachers in their classrooms, I recognized that many of these innovative pedagogical techniques I was trying out for the

first time in my college-level class were already in widespread use in K–12 schools across Nebraska. I believe that the current college students and non-traditional students in my last LOP class were still ahead of the cusp, and had not been exposed to these pedagogical techniques in their primary and secondary school years. I think that is one reason why so many students were resistant to these techniques in LOP. Furthermore, these techniques required more work on the part of the student. They had to participate actively in their learning, and this style of learning did not suit all the students in my class. Many students can learn successfully through a traditional lecture format; why should they change? Especially when the class apparently enjoyed the lectures they were being provided in LOP. One student commented that the lectures were excellent—why change a successful teaching tool? I have come to believe through my experiences in the SEER Program that not all of us learn in the same way. I always knew this to some extent and I think that all of us do—and yet, at least at the University level, we still teach using the basic lecture format. We are afraid that our students will lose content if we don't provide them with it!

### FINAL CLASS EVALUATION

As is typical of most college level classes today, the Geology Department requires instructors to provide students the opportunity to evaluate a class at its conclusion. The Geology Department uses a standard form which asks four specific questions (Part 1) and then presents a series of short statements about the class and asks the student to indicate a response (1 = excellent, 2 = good, 3 = average, 4 = below average, 5 = poor, and NA = does not apply). The instructor cannot see these anonymous evaluations until after all grades have been submitted; most students choose to remain anonymous, although several do put their names on their evaluation forms. Of the 66 students in the course at the semester's end, 32 responses were received. Table 4 provides a synopsis of the results of the final evaluation.

### SUMMARY AND CONCLUSIONS

Teaching the Spring Semester, 1995–96 LOP class was one of the highlights of my entire teaching career. I saw my students learn and evolve (no pun intended) over the course of the semester into more critical thinkers as a result of the bombardment of discussion topics they had to work through each class. For the first time, many of my students were asked to assess their own performance in class. The value they assigned to their work would be the value that I used in determining their final grade. I had been worried all semester that students would uniformly assign themselves 25 points

out of the possible 25 points. I was relieved to find that the student self-assessments ranged between 15–23 points on average, with not one student claiming the full 25 points. I truly believe that the students self-assessed their work accurately and somewhat impartially. If anything, it seemed to me that the better students in the class were more critical of themselves than the poorer students. In conversations with the students both during and after classes, I discovered that the students were, in fact, learning more about LOP than in my previous classes. I recognize that I did not cover nearly as many species names as I usually do in the traditional lecture format, but that names we went through in class were more fully explored and, I hope, retained.

Furthermore, I am convinced that the students will retain *more* of the broad principles and concepts from LOP than they did under the traditional format. By discussing these issues and relating them to themselves in their groups, the ideas being discussed were more deeply ingrained in their minds than they would be by only listening to me and having little interaction with the ideas. Sagor (1992) comments that many times teachers intuitively know what works and does not work in their classroom. They do not need a formal evaluation to demonstrate what is going well and what is not performing up to expectations. I have found this to be true in my class. I always had the feeling, as I observed the interaction among individuals and among the groups in my class, that the students were learning more than they did in my previous classes. It is true that I will have to interview my students one, two, or three years from now in order to compare their responses to my background questionnaire with those of previous students, and I hope to follow up on this over the next several years. I asked my students to provide me with contact addresses, and I intend to begin a new evaluation process next Fall (1996–97).

One of the most rewarding things for me personally was the number of powerful and personal responses I received from my students. Several students sent me unsolicited e-mail letters in which they expressed appreciation for something they learned in class; several students wrote letters to me after the class's conclusion thanking me for making this one of the better classes they had at UNL. This has happened to me once or twice per class on occasion in the past, but never so much as I received this year. Lastly, I was nominated to be the "Outstanding Teacher" at UNL this year, the first time in my professional teaching career that I was ever nominated for such a distinction.

Do I think that the innovative pedagogical teaching strategies I used in my last LOP class really work? You bet I do—and the teacher who once questioned their



Table 4. Final end-of-semester course evaluation results. 32 student evaluations received out of 66 enrolled students in the class. The number in parenthesis indicates the number of responses indicating the same result.

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**Part 1.**

## 1. What, if anything, did you like about the course?

Community/groups	15	Fun	3
Presentations	7	Journal/e-mail	3
Inventive class	1	No boring lectures	2
Extra credit	1	Respectful learning environment	2
Instructor is excited about subject	3	Freedom	1
Test packet	1	Evolution	1
Style	1	Gould book	1

## Quotes for Questions #1:

"I really liked the groups (making us sit together, doing homework together, etc.). Since I am a non-traditional student, it really helped me get to know the people in class. I was hesitant at first about it, though."

## 2. What, if anything, did you like about the instructor?

Enthusiasm/passion	10	Learned most people's names	1
Dynamic/awesome	2	Contagious energy	2
Inspiring	2	Knows/loves subject	8
Excitement	2	People oriented	10
Easy to approach	5	Motivation	1
Fun	1	Gifted/brilliant lecturer	3
Humor	1	Brought subject to life	1

## 3. What suggestions, if any, do you have to improve the instructor's teaching effectiveness?

Eliminate lecture entirely	1
Keep better control of class	2
More time for group work	1
Ask more questions	1
Distribute work better within groups	1
Keep group work	1
Only provide lecture/eliminate groups	1
Vary format of each class	1
None/nothing to improve	8
More disciplined schedule	3
Keep working on "wait time"	1
Better preparation	1
More openness to other evolutionary theories	1

## 4. What suggestions, if any, do you have to improve the course?

Smaller class size/larger classroom	3
Offer course during the day	1
None	2
Fieldwork/hands-on experiences	1
End class on time	1
Less group work	2
Eliminate journals/no e-mail	4
Let out early every now and then	1
Eliminate groups	1
Have groups give the lecture	1
Fewer group presentations	1
Give early-presenting groups more help	1
Great/one of the best UNL classes taken	4

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Table 4. Continued.

**Part 2.**

Please rate the instructor and the course. Unless otherwise noted, use the following scale:

1 - excellent      2 - good      3 - average      4 - below average      5 - poor      NA - does not apply

1. The instructor's preparation for lectures and discussion.  
(1) - 23      (2) - 8      (3) - 1
2. The clarity and helpfulness of the instructor presentation.  
(1) - 17      (2) - 12      (3) - 3
3. The instructor's general teaching effectiveness.  
(1) - 21      (2) - 9      (3) - 2      (4) - 1
4. The instructor's teaching ability compared to other instructors you have had at UNL.  
(1) - 23      (2) - 6      (3) - 3
5. The fairness of the instructor's grading practices and policies.  
(1) - 23      (2) - 7      (3) - 2
6. The clarity of course requirements and objectives.  
(1) - 19      (2) - 9      (3) - 3      (4) - 1
7. The degree to which the course was intellectually challenging.  
(1) - 15      (2) - 10      (3) - 7
8. The extent to which the course stimulated interest in the subject matter.  
(1) - 15      (2) - 9      (3) - 6      (4) - 1
9. The workload of the course compared to other courses the same level you have had at UNL:  
1 - considerably more    2 - more      3 - average    4 - less    5 - considerably less    NA - does not apply.  
(1) - 4      (2) - 6      (3) - 17      (4) - 3      (5) - 1      (NA) - 1
10. The degree to which the course helped you to develop analytical skills, such as thinking, analyzing and expressing yourself clearly.  
(1) - 9      (2) - 12      (3) - 9      (4) - 1
11. The overall value of the course.  
(1) - 15      (2) - 10      (3) - 2

Quotes for #11: "It's worth a lot," "Great class experience," "Journaling was excellent," "I thought the course was very good and interesting. The course approach was different but challenged students to think about things and express ideas by writing, speaking, and working together in groups, very important life skills for work and home environment. Life skills for the real world."

effectiveness in a large, content-rich science class is now and will be a willing practitioner of these techniques in future classes. The most important thing I learned is that it is never too late to objectively investigate one's teaching and learn how to be a better teacher.

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