Viewpoint: Order and Reinforcement in Human Geography: Do They Matter?

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Over a ten-year period students in a two quarter introductory sequence in Human Geography showed contrasting performance on examinations. In the first quarter students were tested after five weeks of work and then again at the end of the quarter on the materials taught during the sixth through tenth weeks of the course. Compared with the first exam, students' grades on the second exam improved an average of 8.43 points. Although the same exam time format was used in the second quarter course, the grades declined from the first to second exam by an average of 9.21 points. Since these patterns were consistent over a wide range of instructional circumstances, the differences in performance were sought in the order in which subjects were taught and the manner in which concepts were reinforced. It appears that reinforcement is more important than the order subjects are taught in helping students score well on examinations. Geographers are urged, therefore, to explore the possibility of using the insights of the writing across the curriculum movement when designing their introductory human geography courses. In addition, this and other pedagogical issues are recommended for formal inclusion in graduate programs training scholar teachers so that future generations of University level geography teachers will be better prepared for actual classroom conditions.

For the past 14 years, part of my teaching assignment at the University of Cincinnati has involved responsibility for a two quarter sequence in human geography. In the first quarter students are introduced to basic geographic concepts and methods, with the major topical focus being population geography. In the second quarter, after a brief review of concepts and methods, students are introduced to political, cultural, urban, and economic geography, in that order.

After ten years of teaching the sequence I noticed a particular pattern to the grades on exams (Tables 1, 2 and 3). In the first quarter, the average grades went up an average of 8.43 points from the first to second exam; in contrast in the second quarter the grades went down an average of 9.21 points from the first to second exam. In both quarters the first exam was given at the end of the fifth week of the quarter; the second exam was

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Table 1: Test scores in first (fall) quarter Human Geography.

Year	Day						Evening					
	First Exam			Second Exam			First Exam			Second Exam		
	mean	s	n	mean	s	n	mean	s	n	mean	s	n
1975	58.3	11.8	118	66.9	14.2	109						
1976S	83.1	20.0	7	87.6	9.9	8						
1977	60.8	10.4	44	71.8	12.7	44	49.0	12.0	27	69.2	16.3	24
1978	78.9	17.4	38	88.6	13.4	38						
1979	75.8	13.0	55	79.8	13.0	55	70.6	20.3	12	88.9	9.0	11
1980	69.7	16.0	56	72.7	12.6	56	73.3	15.2	16	78.1	12.0	16
1981	47.2	8.1	33	76.8	12.2	30	62.2	27.8	9	68.6	26.9	9
1982	NO DATA, ON SABBATICAL LEAVE											
1983	75.0	18.9	95	77.8	13.8	87						
1984	73.7	18.1	117	81.5	18.6	119						
1985	68.6	21.2	131	82.8	18.9	76						
1986S	76.7	22.1	22	88.6	21.3	22						
1986	63.0	10.4	217	84.0	18.7	217	73.5	18.5	15	88.2	14.5	15
1987S	83.3	25.5	25	95.6	15.9	25						
1987	79.8	19.3	217	85.6	17.9	217	84.4	20.9	31	86.6	21.5	31
1988	78.1	17.7	184	84.8	14.9	169	83.9	15.4	30	87.4	16.1	26
1989	86.6	15.0	158	91.1	7.6	167	78.5	24.9	20	92.3	8.1	16

S = summer term; s = standard deviation; n = number taking exam

Table 2: Test scores in second (winter) quarter Human Geography.

Year	Day						Evening					
	First Exam			Second Exam			First Exam			Second Exam		
	mean	s	n	mean	s	n	mean	s	n	mean	s	n
1976S	89.3	18.4	11	72.6	31.2	7						
1977	78.6	15.5	39	62.3	12.8	34						
1978							75.1	25.5	20	64.2	12.7	19
1979	83.2	16.8	38	75.3	23.5	39						
1980	75.9	14.9	108	70.7	14.3	111	78.7	15.9	16	69.3	23.6	16
1981	79.3	10.7	22	76.6	12.9	23	85.6	10.5	11	80.4	18.7	9
1982	71.8	16.1	58	60.7	17.6	58	76.0	15.2	10	67.7	30.9	8
1983	NO DATA, ON SABBATICAL LEAVE											
1984	75.9	13.5	93	62.6	15.7	91						
1985	87.8	12.4	95	78.5	16.1	95						
1986	76.3	20.6	190	67.7	20.4	190						
1987S	83.4	13.8	18	79.1	11.1	18						
1987	66.7	21.7	209	80.4	19.9	209	71.8	19.8	15	83.6	16.4	15
1988	64.5	19.9	217	73.3	19.8	217	81.1	17.9	38	87.9	8.8	38
1989	65.9	19.9	189	76.1	17.9	187	74.5	18.8	31	63.8	19.8	31
1990	65.5	8.9	129	66.2	7.6	123	63.8	7.9	18	67.8	2.1	17

S = summer term; s = standard deviation; n = number taking exam

Table 3: Student's t-test of mean examination scores.

Year	First Quarter		Second Quarter	
	Day	Evening(S)	Day	Evening(S)
1975-76	4.93*			
1976-77	0.54(S)		4.01*	1.34(S)
1977-78	4.24*	4.97*		1.23
1978-79	2.72**		1.71***	
1979-80	1.51	2.83**	2.65**	1.32
1980-81	1.16	0.97	0.79	0.74
1981-82	11.25*	0.46	3.55*	0.69
1982-83	NO DATA ON SABBATICAL LEAVE			
1983-84	1.14		6.24*	
1984-85	3.25*		4.57*	
1985-86	4.98*	1.82(S)	4.09*	
1986-87	10.31*	2.42*** 2.05(S)***	6.71*	2.64** 1.03(S)
1987-88	3.24**	0.4	4.61*	2.1***
1988-89	3.84*	0.84	5.25*	2.18**
1989-1990	3.44*	2.33**	0.72	2.04***

(S) = Summer term
** significant at 5%
* significant at 1%
*** significant at 10.%
Source: Computed by author from data in Tables 1 and 2.

given at the end of the ten-week quarter but covered materials taught during the sixth through tenth weeks. The exams tested a number of things. Least important was mastery of content; typically questions based purely on content were no more than ten percent of the exam. Of intermediate importance was a knowledge of place: students were expected to associate events and issues with where the events and issues took place or were debated. Commonly an additional ten percent of the exam was devoted to testing place geography. Most important was the testing for mastery of skills of analysis and interpretation. In this section of the exam, students were given specific problems and/or data sets and asked to analyze the problem/data using an appropriate conceptual framework and then to suggest a series of possible interpretations or solutions to the problem/data set.

The grade pattern reoccurs over a wide range of circumstances. It is seen regardless of the class enrollment (which varied from 12 to 217), teaching format (solo or team), text used, type of exam (essay, multiple choice, self-generated), whether there was a map section to the exam, student population (traditional or evening college), time of year (Fall-Winter, or Summer terms), length of the course (ten weeks or abbreviated three-and-a-half week summer terms), gender, and student's year in school.

I found these contrasting grade patterns to be both intriguing and disturbing. I was intrigued for several reasons. First, I assumed that a learning curve (Kjerstad, 1918-1919; Nanda and Adler, 1977; Travers, 1963), where students gained familiarity with the material, and my lecture and exam format, seemed to have helped the grades in the Fall quarter. Why did the learning curve appear to have no effect for the Winter? Second, there is an average carry-over in student population from Fall to Winter quarter of some sixty-five percent. Should there not have been some carry-over from the learning curve in the Fall to the Winter quarter?

I was disturbed because it appeared that in the Winter quarter students were only able to do well on examinations dealing with the more conceptually "soft" parts of the course, namely Cultural and Political Geography. When it came to the issues and topics which included "hard" conceptual materials, i.e., Economic and Urban geography, students seemed unable to grasp either the concepts or the content of the lectures or the readings. This did not appear to be true for Fall quarter where the conceptual material was consistently "hard." I began to worry about what the students where taking away from the Winter quarter. Given the notorious fall-off in short-term memory (Kintsch, 1977; Travers, 1963), it appeared that in the long-run, students would forget the easier, conceptual "soft" materials although they had done well on exams, and in addition have little knowledge or appreciation of the conceptually more rigorous sections of the course and the discipline. This pattern violated one of the underlying goals of the course. I specifically sought to help students develop a set of conceptual frameworks to deal with the range of problems and questions geographers deal with, so that in the future they could readily interpret new factual material. This goal was repeatedly emphasized in the course. In addition, the problems of the fall-off of short-term memory was also discussed.

Four years ago, in 1986, I began to seek the answers to why the grade patterns appeared as they did. Colleagues in the Department of Curriculum and Instruction at the University of Cincinnati, after reviewing my data, suggested that since students had performed similarly for so many years over such a broad range of examination conditions and situations the difficulty of examinations could be ruled out as a major explanatory variable. They recommended that I seek the answers to the pattern of grade changes in the order the materials were presented and how the materials were reinforced.

A NATURAL EXPERIMENT

In order to test whether order or reinforcement was the determining factor in Winter quarter examination performance, I devised a natural experiment, whereby I systematically changed the order and exercises in both quarters. I was able to do this as there were always two or three sections of each course which I taught. These sections were distinct sections of the same class taught at different times and in different rooms. Apart from incorporating new examples into the course, no major revision of any lecture was undertaken during the course of the experiment.

In stage one of the experiment during Fall and Winter 1986-1987, I changed the order of the lectures. In first quarter I still started with concepts and methods, but in teaching population geography I reversed the order of the subjects, i.e., I dealt with migration before fertility, mortality, population theory, and policy. Writing exercises included a bibliographic search, a choropleth mapping exercise, a letter to the editor dealing with population policy, and a country profile where students were asked to search the literature and define what the selected country's population problem is. Evidence for the problem and government policy initiatives for solving the problem are also part of the exercise. The country profile must also include a statistical appendix which includes current data on basic demographic measures. These exercises have been used in the first quarter course for the past fourteen years. The grades from the first to second examination improved by an average of 11 points. Since this increase was well within one standard deviation of the average improvement with the standard order of subject matter from the past, my belief that in the Fall quarter the learning curve was operative was reinforced and that order was not as important as reinforcement in determining student success in exams. In the Winter I began with Economic and Urban geography, and finished with Cultural and Political geography. The grades from the first to the second exam improved by an average of 12.74 points. Some of the improvement may have been due to the learning curve. However the pattern of improved grades was exactly what I had expected: in starting with hard materials and progressing to easier, grades would be lower when testing the harder material and could have improved as easier materials were tested.

In stage two of the experiment in 1987, Fall quarter was returned to its original schedule and thereafter only the Winter quarter was used. The two sections of human geography were handled differently. Section one, taught on a Monday-Wednesday-Friday schedule, was taught using the old format (Political-Cultural followed by Economic-Urban) but included a series of two exercises using Cincinnati as a study area. In one exercise a minimum of fifteen factories or stores had to be plotted on a map and the distribution described and explained using explicitly either industrial or marketing location theory. In the second exercise an urban land use map of Cincinnati was to be analyzed and the land use patterns described and analyzed using either the Burgess, Hoyt, or Harris-Ullmann model. Students were forced to choose one of the three and justify their choice as to which model best described and explained Cincinnati's land use. Section two, taught on either a Tuesday-Thursday or a Tuesday night schedule, was taught using the Economic-Urban lectures first, with the course ending with the Political-Cultural lectures. The exercises in section two involved Cincinnati as a study area but the topics were Findlay Market, a local out door food market, and the location of religious institutions. [These two exercises were the standard ones used for the ten-year period before the experiment was started.] Identical questions were used on the examinations for both sections. The results of the examinations were most telling. In section one, grades on the second exam improved by an average of 8.8 points over the first exam. In section two, grades also improved by an average of 6.8 points. For section one this suggested that order was less important than reinforcement since I lectured

using the topics which had brought the lack of improvement in grades from exam to exam to my attention. In section two the results were identical to what was observed in the Winter of 1987 and I choose to interpret them similarly: I had started with the harder materials and so, when these materials were tested, the grades were low; when the easier materials were tested, grades went up.

In stage three of the experiment, during Winter quarter 1989, section one was taught using the format Political-Cultural-Urban- Economic, while section two was taught using the format Economic- Urban-Political-Cultural. Both sections were required to do the same exercises which involved urban and economic models as applied to Cincinnati. Again the same questions were used on the examinations for the two sections. In section one the grades improved from the first to the second exam by an average of 10.25 points; in section two the grades were better on the first exam by an average of some 10.67 points. The grades in section one I feel demonstrate the validity of my working hypothesis, namely that reinforcement is an important determinant of student performance. I was somewhat taken aback by the grades in section two. Students quickly supplied what was, from their perspective, an explanation for the decline in grades. They enjoyed doing the exercises and missed having written work dealing with political and cultural topics. Since there were no exercises, enthusiasm and interest fell off, with the resulting decline in grades. In Winter 1990, I tried to remedy this by the use of several video tapes, one dealing with *Hajj* to Mecca and one dealing with Buddhism. This addition of the cultural materials appears to have the result of keeping students' interest and attention because in both sections of the course grades improved from the first to second exam by an average of 0.77 in section one and by 3.95 points in section two. Although the improvement in scores was below average for the ten-year period I am considering as a base line, nevertheless student interest in the course was constant over the ten weeks.

CRITIQUE

The three stages of the experiment lead me to believe that in teaching introductory human geography, reinforcement in the form of exercises is a better determinant of improved student performance on exams than is the order in which the subjects themselves are taught. Some may question whether or not this conclusion is truly warranted. In some forty percent of the cases the increases or declines in average grades are not statistically significant. Furthermore the experiment was rushed from stage to stage. Surely the same combination of order and exercises should have been repeated over a number of years to see if the grade changes were consistent for each combination. In addition, others may object that what I have found is neither new nor revolutionary and therefore not of great interest to the profession.

I readily admit to the validity of the first two possible criticisms. However, there are other issues at stake beyond statistical significance and the speed of the experiment. With regard to significance, I would point out a two-fold existential significance to the

changes in average grades. First, the differences often determined whether a student passed or failed, and commonly made a difference in terms of a letter grade. Second, students' attitudes towards the material were enhanced when grades improved. This change was further reflected in students' willingness to engage in classroom discussion. In contrast, when grades fell, student attitudes towards the class deteriorated and their willingness to either ask questions in class or participate in more general class discussion weakened.

With regard to the speed with which the stages of the experiment progressed, I readily admit that I was overcome by events. As Chairman of the Ad Hoc General Education Committee at the University of Cincinnati I was, and am, intimately involved with faculty development, and especially with faculty development in the area of writing across the curriculum (Freisner and Peterson, 1981; Fulwiler, 1985; Griffin, 1983; Irmscher, 1979). In a series of seminars on the use of writing, I came to discover just how effective writing can be used as a tool in the learning process. As such I felt like the physician who knows of a new, more effective, but untested, cure for a disease who prescribes the new cure despite the lack of test results showing unequivocal advantages to his patients. How could I not use the exercise sequence which maximized student performance? Would it be fair to those students who got the combination which was not as effective? Could I not help changing the lectures for these students to help them overcome the disadvantages of combination? This latter approach would have definitely spoiled the experiment. Furthermore, should I not try to balance the exercises over the entire ten-week quarter and over as many subject areas as possible?

The third criticism is perhaps more difficult to deflect. However, I would argue that the phenomenon of grade patterns is not well recognized nor is it well publicized. Over the past four years when I would mention my experiment to colleagues at the University of Cincinnati who have taught the Human Geography sequence or other introductory geography sequences, they expressed interest and surprise since they had not noticed such patterns of grade changes. The same reaction was forthcoming from colleagues at other Colleges and Universities. If indeed this pattern of grades is so common, why it is not formally taught in graduate studies to those geographers planning an academic career. Two possibilities exist: either the phenomenon is not widely appreciated or it is not well documented in any formal geographic literature. Another perspective on this criticism can be derived from the questionnaires commonly sent out with desk copies of new introductory text books. The questionnaires probe into faculty reactions to the clarity of writing, graphics, and of most importance order of subjects. Book company representatives frequently try to sell a text on the basis of reaction to these questionnaires which report that the order of the chapters was important and the order used in the given text was appropriate and appreciated. The final perspective on this criticism is from the ever more common practice of book publishers of providing model exams in form of either hard copy or computerized test banks (on diskettes). Judging from the content of the exams and their popularity, I would gather that there is little we as instructors need do except follow the chapters in order and thus student performance on exams would be high and consistent.

IMPLICATIONS

In presenting the natural history of my introductory human geography course at this point in time, the reader may suspect that I have a hidden agenda in regard to how such a course should be taught. This is not the case. I am not advocating any one way to teach introductory human geography; I am not suggesting any one way as ideal to test student progress in human geography; I am not recommending that subject matter be taught in any given order. By extension, slavish following of chapter order, especially where there is little or no carry-over in conceptual material from chapter to chapter—as is often the case in introductory human geography text books—does not seem to be an effective teaching strategy to follow. Rather, what I hope to accomplish by publicizing my classroom experience is to start a debate and dialogue among those of us with an interest in teaching introductory human geography. I am asking that we seriously consider whether or not we are using the most effective ways to engage students in their study of geography. It seems to me that as a discipline, geography is ideally poised to use writing as a learning tool, especially when writing is combined with "geographic" skills such as mapping and spatial analysis. We should be systematically exchanging exercises, especially those we have found to be effective and yes, popular, among students. My suspicion is that by adopting a more systematic use of writing as a learning tool, several immediate and long-term benefits will develop. Our classes will be more enjoyable to teach. Student appreciation of the power of geography as a discipline will grow. Longer term retention of both the facts and the conceptual materials taught promise an overall more geographically literate society whose members can make informed choices in regard to those life decisions with a spatial component. I come to these conclusions based on student reactions to my use of both formal and informal writing as a teaching tool. By the end of a quarter in Human Geography, students are enthusiastic about exercises and the various uses of writing. The further we are into a quarter the less I hear that my course is supposed to be a course in Geography not English composition. Finally I am suggesting that this and other similar educational issues be more formally integrated into our graduate education programs. It is not uncommon in the United States today to have formal orientations to graduate teaching responsibilities mandated by State legislatures for new teaching assistants. It is also increasingly common for new faculty to have similar orientations. It is imperative that a literature exist that we can turn to in order to document what future teachers can actually expect to find in the classroom so that they may be prepared and be more effective.

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