10-16-2000

The impact of varying teaching style techniques to better match learning styles in the science classroom

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The Impact Of Varying Teaching Style Techniques To Better Match Learning Styles In The Science Classroom.

by
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A Thesis

Submitted in partial fulfillment of the requirements of the
Master of Arts Degree in the Graduate division
of Rowan University
December, 2000

Approved by

Professor

Date Approved October 16, 2000

ABSTRACT

Karen M. Santoro, The Impact Of Varying Teaching Style Techniques To Better Match Learning Styles In The Science Classroom, Dr. Richard Meagher, Subject Matter Teaching: Biology

This paper will address the correlation between student learning styles and the mode of delivery employed for instruction, and the outcome: student test scores.

By integrating a learning style assessment with a teaching style assessment the researcher challenges the belief that science needs to be taught in a systematic, methodical fashion and varying teaching style will result in significantly higher test scores. The test scores of a class taught with traditional science teaching delivery, (lecture style) to the test scores of a class taught with various teaching styles were then compared.

The method employed involved using a learning style survey to assess the learning preferences of the students and using a teaching style survey to evaluate the teaching techniques employed in the classroom. A comparison of the results and utilization of the data was used to plan lessons to match the learning style preferences of the students.

Findings show that there was negligible differences in the test scores of the control and experimental groups. Although no significant increase in test scores was noted, the experimental group students did increase class participation and voice their enjoyment of the varied lessons.

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CHAPTER 1

Introduction

There seems to be an ubiquitous notion that all students must approach the learning of science in the same way. This is evidenced by the very pigeon-holed, albeit organized, lecture-based approach most people take in teaching science.

The idea persists that there must be strict rules, procedures and guidelines to follow to insure classroom control and thus an orderly and efficient science learning environment. Science teachers are notorious for lecturing and giving a copious amount of notes. Unfortunately this style does not take into consideration the wide, diverse nature of the learner but rather seeks to homogenize the students into a narrow learning style that we as science teachers have deemed to be most efficient. Conversely, this style also lends itself to a great disparity in attitudes about learning science and also in the range of grades obtained.

Students learn in different ways. Each student feels a certain level of success with a particular style of learning. Some students who are successful in one learning environment may be less successful in another. This does not necessarily relate to aptitude but more likely to the mode of delivery of the subject matter. Many teachers

rely on the methods used when they were taught and they as students felt a level of comfort and success. In a classroom, the mode of delivery is based on the teacher's perception of what is the most effective teaching style that will result in the most learning. That perception, unfortunately, is often the antithesis of the students perception, experience and reality.

This paper will explore various teaching and learning styles and the probability of increasing student test scores by varying the traditional lecture style technique employed in a science classroom with alternative teaching styles. Other teaching styles employed (facilitator, demonstrator,...) could include the following teaching techniques that one would not be exposed to or experience in a lecture based teaching style: student centered group work, computer based lessons, debates, creative writing, "games", contests, role playing and discussion.

CHAPTER 2

Literature Review

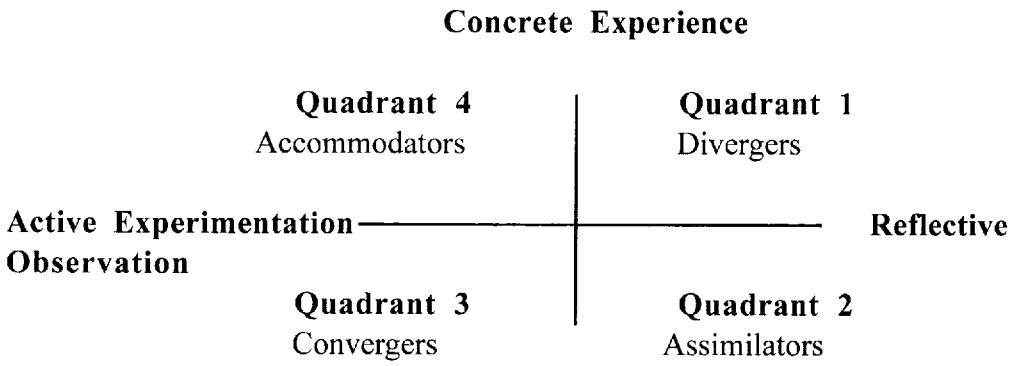
Scores of teachers, psychologists and institutions have profiled the impact of teaching and learning style integration. Variations appear in the terminology used to describe the styles and the methods employed in obtaining data but most agree that there is a correlation between teaching to the various learning styles and assessment outcome. Information about style can help instructors become more sensitive to the differences that students bring to the classroom. It is a useful guide in matching learning styles to the learning experience. Matching is helpful to all students but most appropriate in working with poorly prepared or poorly motivated students, as the most attrition occurs in those situations. Studies show that identifying a students style and then providing instruction consistent with that style contribute to more effective learning (Claxton, Murrell, 1988).

A study conducted by Sally Bottroff-Hawes (1988), a middle school vice principal, strongly suggests the impact a varied style of delivery has on the group of students she refers to as hard-to-reach. These are the students we see fall through the

cracks, the bored students, the ones that daydream away class time. Her study was conducted over a two year period in a middle school, and covered all disciplines not just science. The premise of her study was to determine if there is one preferred teaching/learning style among the at risk students. The results of her study indicate a strong preference for right -brained learning over left-brained learning for this group of students. The teachers were then surveyed and completed a teaching style inventory. Teacher inventory results showed a preference to left-brain teaching styles, with few right-brained styles injected. The overall impact of her study allowed for the inservicing of teachers on various teaching styles, the introduction of varied teaching methods into the classes and resulted in a marked improvement in the GPA's of the students. Bottroff-Hawes research suggests that instructors do not have to teach exclusively to one's specific learning style but rather to become aware of the fact that we all learn differently and to provide for those differences by offering a balance of instructional modes.

Dr. David Kolb, in 1971 created a learning theory based on how one perceives information and how they process that perception. The theory incorporates these two dimensions and resulted in Kolb's classification of four different learning styles. Kolb called the sensing/feeling dimension the Concrete Experience, the watching dimension was referred to as Reflective Observation, the thinking dimension was called Abstract Conceptualization, and the doing dimension became known as Active Experimentation. By placing these descriptors on an X/Y-Axis Model, Kolb classified four quadrants of learning and the types of learners satisfied by each quadrant. (See figure 1:)

Figure 1



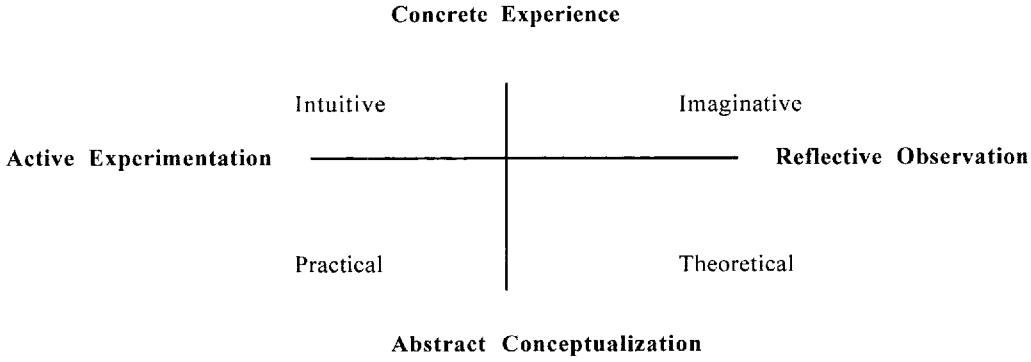
- Quadrant 1 learners Kolb refers to as Divergers. The learners in this quadrant take in (perceive) information concretely but process that information reflectively. They are sensor/feelers and watchers.
- Quadrant 2 learners Kolb calls Assimilators. They perceive information abstractly and they process this information reflectively. They are thinkers and watchers.
- Quadrant 3 learners Kolb refers to as Convergers. These learners perceive abstractly and then process what they take in actively. They are thinkers and doers.
- Quadrant 4 learners are the Accommodators. They take in experience concretely and process that information actively. They are sensor/feelers and doers.

Carl Jung, in his book Psychological Types (1976), examined the differences in the way people perceive and process information. He identified four categories, feelers, thinkers,sensors and intuitors, that are strikingly similar to Kolb's model.

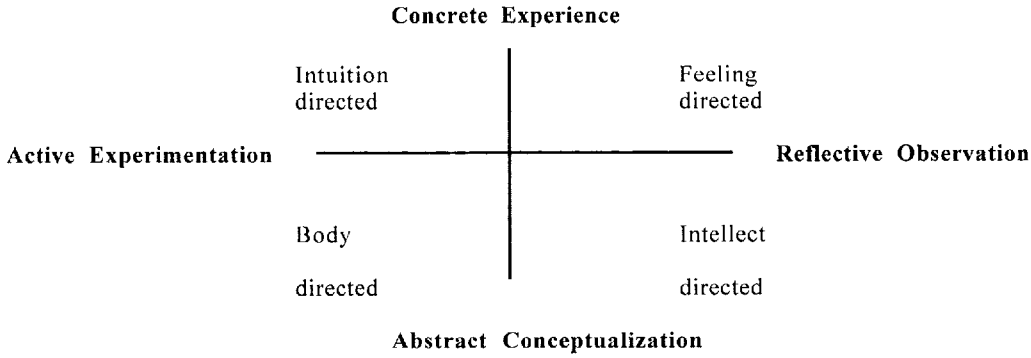
Kolb's work inspired Bernice McCarthy, the guru of the 4MAT system of learning, to believe that the use of diverse teaching and learning strategies would improve

learning for all students. The 4MAT system is based on Kolb's idea of the two major differences in learning: how we perceive information and how we process information. Through extensive examination of the work of numerous educational researchers, psychologists and theorists, McCarthy identified common threads of information. She created an overlay of various researchers findings to that of the Kolb model and found striking similarities. Notice the comparison between the theories of Kolb, Jung and McCarthy (See figure 2:)(McCarthy, 1980).

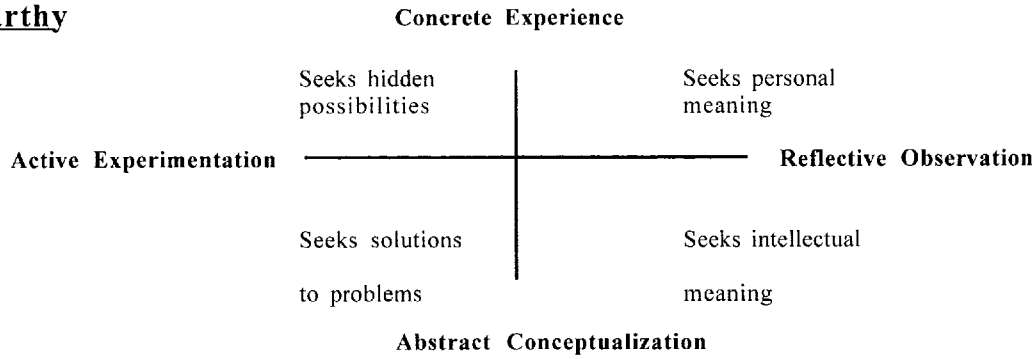
Kolb



Jung



McCarthy



Based on her findings and the differences she had noted in her own students, McCarthy used Kolb's Learning Style Inventory and developed an eight step teaching cycle which incorporates both hemispheres of the brain with various learning styles and teaching techniques. Her eight step cycle, followed sequentially by the teacher and then continually repeated, would expose students to not only their preferred learning style but also their non preferred styles as well. McCarthy feels by creating a balance between comfortable and challenging learning experiences we open the door to greater learning success for all students. And, as teachers let go of their rules and adapt 4MAT to their needs, they begin using the pieces simultaneously, intuitively, without conscious analysis (Walsh, 1987).

Bob Samples and Bill Hammond team up with Bernice McCarthy to apply the 4MAT system to science teaching (Samples, Hammond, McCarthy,1985). Their work focuses on moving science teaching away from the narrowness of fact dissemination to a wider exploration of science as a uniquely human endeavor with its explorations approaching the issues of the quality of life and the very possibility of its survival on this planet (Samples, Hammond, McCarthy, 1985). They believe the incorporation of emotion, values, excitement, commitment, and concern should join the arena of discipline, responsibility and integrity. Ingrained in their work is the definition of science as described by noted science educator Dr. Mary Budd-Rowe. Dr. Budd-Rowe feels that science education has four essential aspects that are critical to successful scientific understanding, but three of the four are almost always left out of the learning process. The four steps include:

- ways of knowing,
- actions/applications,

- consequences
- values.

Rowe contends that science instruction tends to omit all of the four steps except the ways of knowing, and by doing so we have disenfranchised a great many students.

Anthony Grasha (1996) identified five teaching styles or strategies that are used by college and junior college professors: expert, formal authority, personal model, facilitator and delegator. He further classified these styles into four teaching clusters:

- the expert/formal authority cluster leans toward teacher-centered learning where the teacher presents information and students receive knowledge.
- the personal model/expert/formal authority cluster is also teacher centered but emphasizes modeling and demonstration. This style encourages observation and not just content.
- the facilitator/personal model/expert cluster is student-centered. Teachers design activities, interactions or problem solving situations for student that allow them to practice processes for applying course content.
- the delegator/facilitator/expert cluster places the burden of learning on the student. Teachers provide complex tasks that require student initiative and often group work to complete.

Grasha's plan includes an inventory that teachers can take online(Grasha, 1996). A computer generated score and cluster range for the score is charted. Questions are designed to help instructors to become aware of their mode of delivery for a particular course and then with the results evaluate their style for effectiveness in the classroom.

R.M. Felder, an Engineering professor at North Carolina State University, developed a model of learning styles and a parallel model of teaching styles. Felder

believes that a mismatch between learning and teaching styles result in students becoming bored, inattentive in class and doing poorly on tests (Felder, 1996). He has identified four dimensions of learning.

- Active and Reflective Learners - Students who are considered active learners retain information best by doing something active, i.e., discussing, explaining, applying. Reflective learners like to process the information internally before becoming "active".
- Sensing and Intuitive Learners - Sensing learners like to learn facts, solve problems, they are patient with details and good at memorizing. Intuitive learners dislike repetition, they work fast and don't like "plug and chug" classes with a lot of memorization and routine calculations.
- Visual and Verbal Learners - visual learners prefer to see pictures, diagrams, flow charts and demonstrations. Verbal learners retain more information if it is presented with written and spoken explanations.
- Sequential and Global Learners - Sequential learners prefer to process information in logical steps whereas global learners prefer to see the "big picture" and try to put the pieces together in novel ways.

The idea behind Felder's research is not to teach each student exclusively according to his/her preferences, but rather to strive for a balance of instructional methods which correlates with the ideas of McCarthy and Hawes. By creating this balance students will be taught partly in the manner they prefer, which leads to an increase in comfort level and willingness to learn, and partly in a manner they prefer less, which will provide practice and feedback in ways of thinking and problem solving with which they may not be initially comfortable with but will need to become fully effective learners (Felder, 1988).

Felder further states that a major transformation of teaching style is not necessary just a conscious effort be made to address the different learning styles at least some of the time.

Rita Dunn, the director of the Center for the Study of Learning and Teaching Styles at St. John's University in New York has worked tirelessly, since 1967, to promote the importance of teaching to ones learning style (Dunn and Dunn, 1993). Having published numerous papers, articles and monographs on the subject, Dunn believes that teachers do not necessarily have to adapt to each learners learning style, rather the teacher must just be aware that there are differences in their students learning styles and to be prepared with alternative instructional methods and resources. By looking at the results of a valid survey instrument a teacher can better assess the five areas that impact learning for the student. Dunn's Learning Style Inventory(LSI) assesses the following areas:

- immediate environment -sound, light, temperature and seating design
- emotionality - motivation, persistence, responsibility/conformity and need for internal or external structure
- sociological - learning alone, in pairs, as part of a team
- physiological - auditory, visual, tactile/kinesthetic, food and liquid needs, time-of-day energy levels
- indications of global or analytical processing inclinations - through correlation with light, sound, design, peer-orientation

A meta-analysis, conducted by thirteen universities, between 1980 and 1990 of forty-two experimental studies, using the Dunn and Dunn Learning Style Model, supports the belief that teaching to learning style has a significant impact on the learners achievement. The study asserts that students who were accommodated by educational interventions

responsive to their learning styles could be expected to achieve 75% of a standard deviation higher than students whose styles were not accommodated (Dunn et al. 1995).

Not all research supports the congruence of learning style and teaching styles. Spoon and Schell(1998) conducted a study which investigated the effect of learning and teaching style on the achievement of basic skills. Twelve teachers and 189 students in a public, coeducational, two- year technical school were evaluated and the findings showed:

- both students and teachers preferred a teacher centered approach
- that no statistically significant difference existed between interaction of teaching style and learning style on student's levels of academic achievement.
- that no statistically significant difference existed between congruent and incongruent student groups on age, ethnicity, and gender in terms of the interaction of learning and teaching style
- that a statistically significant difference existed in terms of the interaction of age with learning style.

In 1997 the Journal of Instructional Psychology surveyed students enrolled in two universities, Weber State University (UT) and Emporia State University (KS) on their preferences and dislikes for various teaching styles. Students surveyed were at all grade levels (17 first-year students, 44 sophomores, 66 juniors, 50 seniors and 71 graduate students) and in a variety of classes and majors. A simple survey was conducted asking the students to select their preferred style and the styles they disliked. Their choices were:

- Lecture only with no student participation
- Mainly lecture with some voluntary student participation.
- Mainly lecture with required student participation.

- Mainly lecture with some demonstration.
- Mainly demonstration.
- Mainly lecture with some student discussion groups.
- Mainly professor-assisted class discussion.
- Mainly student discussion groups.
- Mainly class presentations by other students
- I do not have a preference.

There was a comment space provided at the bottom of the survey so students could explain why they liked or disliked a particular teaching style. The results showed a clear preference for lecture style classes with some interspersion of voluntary student participation and lecture with some student discussion groups. There was a strong dislike for those teaching styles which were straight lecture, those that required student participation, and lessons mainly focusing on student discussion groups and lessons involving mainly student presentations. The essence of the comments was that the students felt they should be learning from an expert in the field and the professor was that expert and lecturing was an effective way to disseminate information (Beishline,Holmes, 1997).

Not surprisingly, most of the research leans towards varying teaching style to accommodate the wide variety of learning styles found in our classrooms. The accompanying research will evaluate the theories discussed in this literature review by implementing and comparing several of the proposed teaching techniques (varied teaching styles vs lecture) and evaluating the assessment outcomes (test and quiz scores.)

CHAPTER 3

Statement of Problem and Significance of Study

This paper will address the correlation between student learning styles and the mode of delivery employed for instruction and the outcome: student test scores.

By integrating a learning style assessment with a teaching style assessment the researcher will dispel the belief that science needs to be taught in a systematic, methodical fashion and that varying the teaching style to better suit the needs of the learner will result in significantly higher test scores. It is the intent of this paper to compare test scores of a class taught with traditional science teaching delivery, (the "stand and deliver" or "chalk and talk" lecture style) to the test scores of a class taught with various teaching styles designed to be compatible with the learning styles of the students. The test scores will be compared by the percentage of students attaining each of the five letter grades, A = 92%-100%, B = 85% - 91%, C = 76%-84%, D = 70% - 75% F= below 70%.

This study is of critical importance to teachers in general, but as a science teacher it is particularly important because it will ameliorate the fostering of scientific interest, improve test scores and enhance the desire to pursue a science related career in our young people.

Quite often science teachers hear the following type of comments: "I stink in science;" " I'm not that smart;" or "My last science teacher was terrible, I didn't learn anything." Parents of science students had similar school experiences and comments such as "Oh, I never did well in science either;" or "I always hated science it was too hard and so boring;" are all too common. If we had a crystal ball and could look back at some of those classrooms, teachers and experiences, they would undoubtedly show a mismatch of teaching and learning styles.

By using a learning style survey one can assess the learning preferences of the students. By using the teaching style survey teachers can consciously evaluate the techniques they tend to employ in their classrooms, especially those that are ingrained and most dominant. Comparing the results and utilizing the data to better meet the needs of the students will benefit both parties. Students will feel empowered and a part of the learning process which will result in scientific interest, improve test scores and an appreciation for other learning styles. Teachers will reach more students, accomplish more in their given time with students, and improve and/or increase their repertoire of teaching techniques.

CHAPTER 4

Methodology

To determine the effectiveness, if any, of teaching to students learning styles, students at Buena Regional High School, in Buena, New Jersey, enrolled in a senior science elective, Environmental Biology will act as the control and experimental groups.

Using a learning preference inventory, designed and written by R.M. Felder and Barbara Soloman of North Carolina State University, each student in the experimental class will take a questionnaire type survey available on the Internet (See Appendix, p76.) The scores and learning preferences were calculated for the experimental group and used to create unique lessons designed to explore the various learning styles of the students. The scores and learning preferences were then calculated for the control group but all lessons in the control class were taught strictly by lecturing techniques. Both classes received the same quizzes and tests. The only variable in the experiment will be the mode of information delivery. The material covered involved 12 weeks of lessons, which included 11 quizzes and 5 tests (See Appendix pps 86-131.)

The individual responses to the Learning Inventory were calculated as follows :

1. Put "1"s in the appropriate spaces in the table below (e.g. if the student answered "a" to Question 3, they would put a "1" in Column "a" by Question 3).

2. Total the columns and write the totals in the indicated spaces.

3. For each of the four scales, subtract the smaller total from the larger one. Write the difference (1 to 11) and the letter (a or b) with the larger total.

For example, if under "ACT/REF" you had 4 "a" and 7 "b" responses, you would write "3b" on the bottom line under that heading (3 = 7- 4, and the "b" total was the larger of the two.)

	ACT/REF			SEN/INT			VIS/VRB			SEQ/GLO	
Q	**a**	**b**	**Q**	**a**	**b**	**Q**	**a**	**b**	**Q**	**a**	**b**
1	__	__	2	__	__	3	__	__	4	__	__
5	__	__	6	__	__	7	__	__	8	__	__
9	__	__	10	__	__	11	__	__	12	__	__
13	__	__	14	__	__	15	__	__	16	__	__
17	__	__	18	__	__	19	__	__	20	__	__
21	__	__	22	__	__	23	__	__	24	__	__
25	__	__	26	__	__	27	__	__	28	__	__
29	__	__	30	__	__	31	__	__	32	__	__
33	__	__	34	__	__	35	__	__	36	__	__
37	__	__	38	__	__	39	__	__	40	__	__
41	__	__	42	__	__	43	__	__	44	__	__

ACT/REF		SEN/INT		VIS/VRB		SEQ/GLO	
a	b	a	b	a	b	a	b
__	__	__	__	__	__	__	__

(Larger - Smaller) + Letter of Larger (see below*)

____ ____ ____ ____

*Example: If you totaled 3 for a and 8 for b, you would enter 5b.

It is assumed that by altering teaching style to better match the learner there will be a marked difference in the test and quiz grades of the two groups with the experimental group grades being higher. It is further assumed that there will be a greater disparity in learning styles in the larger, experimental group(period 1) and that the grade differential will be more pronounced with the larger group acting as the experimental group rather than if the class with fewer students(period 9) were used as the experimental group.

The initial assumptions and limitations were noted before testing began and are as follows:

- There will be only one control group and one experimental group.
- The classes do not meet at similar times of the day. One class, the experimental group, meets during the first period of the day from 7:43 am to 8:23 am while the other class, control group meets during the last period of the day from 1:35 pm to 2:15 pm.
- There is a considerable number of tardy students during the first class period (experimental group.)
- There are often students dismissed early for sports, college visits or personal matters from the last class period (control group.)
- There are 24 students in period 1, the experimental group, compared to only 11 students in period 9, the control group.
- Academically, the two groups are heterogeneously mixed but each group exhibits a unique personality and varied social interactions.

Statistically the classes compare as follows:

- Percentages of male and female students:

Period 1 (experimental)	Period 9 (Control)
Males = 42%	Males = 27%
Females = 58%	Females = 73%

- Percentages of races:

Period 1 (experimental)		Period 9 (Control)	
Black	= 0%	Black	= 9%
White	= 88%	White	= 82%
Hispanic	= 8%	Hispanic	= 9%
Asian	= 4%	Asian	= 0%

- Average of test scores per quarter for first period class, experimental group:

Quarter 1		Quarter 2	
A (92-100)	= 19%	A (92-100)	= 15%
B (85-91)	= 29%	B (85-91)	= 28%
C (76-84)	= 23%	C (76-84)	= 23%
D (70-75)	= 17%	D (70-75)	= 19%
F (below-70)	= 12%	F (below-70)	= 15%

- Average of test scores per quarter for ninth period class, control group:

Quarter 1		Quarter 2	
A (92-100)	= 18%	A (92-100)	= 21%
B (85-91)	= 18%	B (85-91)	= 19%
C (76-84)	= 32%	C (76-84)	= 29%
D (70-75)	= 18%	D (70-75)	= 15%
F (below-70)	= 14%	F (below-70)	= 16%

CHAPTER 5

Results

Results of student learning style inventories were collected via the Internet and scored on the Web. The students were asked not to include their name only to identify themselves with a pseudonym. This method was chosen to insure the confidentiality of the students and promote freedom in response. See Appendix, sample 3, for a list of the questions and a scored response sheet.

Survey Results are charted on a scale of 1-11 for each dimension. The scores indicate a preference for a particular dimension on Felder's scale. According to Felder:

- scores between 1-3 indicate a fairly even balance between the two dimensions of that scale.
- scores between 5-7 indicate a more moderate preference for one dimension on the scale and indicates that a student would learn more easily in a teaching environment which favors that dimension.
- scores between 9-11 indicate a very strong preference for one dimension on the scale. It also indicates that a student may have real difficulty learning in an environment that does not support that preference.

Summarization of Individual Student Responses -Experimental Group

Student 1

Active	_____	__3__Reflective
Sensing	__1__	_____Intuitive
Visual	_____	__5__Verbal
Sequential	__9__	_____Global

Student 2

Active	__7__	_____Reflective
Sensing	_____	__1__Intuitive
Visual	__9__	_____Verbal
Sequential	_____	__1__Global

Student 3

Active	__5__	_____Reflective
Sensing	_____	__7__Intuitive
Visual	__9__	_____Verbal
Sequential	__5__	_____Global

Student 4

Active	__3__	_____Reflective
Sensing	__7__	_____Intuitive
Visual	_____	__3__Verbal
Sequential	__1__	_____Global

Student 5

Active	__1__	_____Reflective
Sensing	__7__	_____Intuitive
Visual	__3__	_____Verbal
Sequential	_____	__3__Global

Student 6

Active	__3__	_____Reflective
Sensing	__9__	_____Intuitive
Visual	__1__	_____Verbal
Sequential	__3__	_____Global

Student 7

Active	__3__	_____Reflective
Sensing	__5__	_____Intuitive
Visual	_____	__7__Verbal
Sequential	_____	__1__Global

Student 8

Active	1	Reflective
Sensing		3 Intuitive
Visual		1 Verbal
Sequential	3	Global

Student 9

Active	7	Reflective
Sensing		5 Intuitive
Visual	3	Verbal
Sequential		9 Global

Student 10

Active	1	Reflective
Sensing		3 Intuitive
Visual		3 Verbal
Sequential	7	Global

Student 11

Active	5	Reflective
Sensing	9	Intuitive
Visual	7	Verbal
Sequential	5	Global

Student 12

Active		7 Reflective
Sensing		3 Intuitive
Visual		5 Verbal
Sequential	9	Global

Student 13

Active	3	Reflective
Sensing	9	Intuitive
Visual	1	Verbal
Sequential	3	Global

Student 14

Active	3	Reflective
Sensing		5 Intuitive
Visual		3 Verbal
Sequential		5 Global

Student 15

Active	__1__	_____Reflective
Sensing	__3__	_____Intuitive
Visual	_____	__5__Verbal
Sequential	__7__	_____Global

Student 16

Active	__1__	_____Reflective
Sensing	__5__	_____Intuitive
Visual	__7__	_____Verbal
Sequential	_____	__3__Global

Student 17

Active	__5__	_____Reflective
Sensing	_____	__7__Intuitive
Visual	__9__	_____Verbal
Sequential	__3__	_____Global

Student 18

Active	_____	__3__Reflective
Sensing	__1__	_____Intuitive
Visual	_____	__3__Verbal
Sequential	__7__	_____Global

Student 19

Active	__1__	_____Reflective
Sensing	_____	__3__Intuitive
Visual	__5__	_____Verbal
Sequential	_____	__7__Global

Student 20

Active	__3__	_____Reflective
Sensing	__1__	_____Intuitive
Visual	__1__	_____Verbal
Sequential	_____	__3__Global

Student 21

Active	__7__	_____Reflective
Sensing	__9__	_____Intuitive
Visual	__9__	_____Verbal
Sequential	_____	__5__Global

Student 22

Active	__7__	_____Reflective
Sensing	_____	__1__Intuitive
Visual	__9__	_____Verbal
Sequential	_____	__1__Global

Student 23

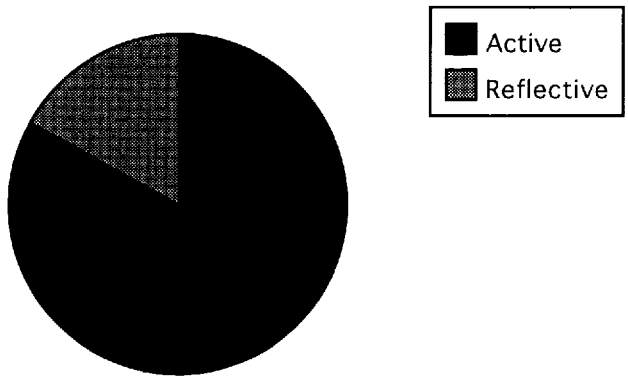
Active	__3__	_____Reflective
Sensing	__5__	_____Intuitive
Visual	__3__	_____Verbal
Sequential	__1__	_____Global

Student 24

Active	_____	__5__Reflective
Sensing	__3__	_____Intuitive
Visual	__3__	_____Verbal
Sequential	_____	__3__Global

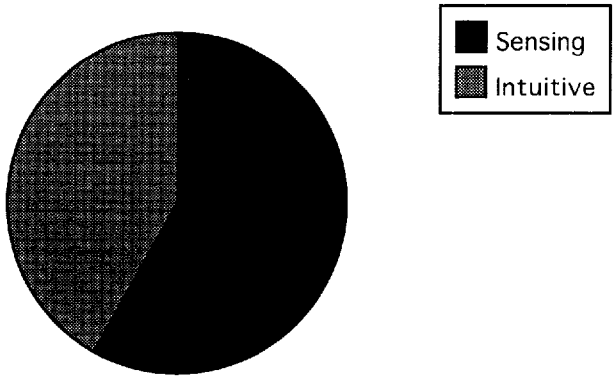
Summarization of data

Active Learners = 83%
Reflective Learners = 17%



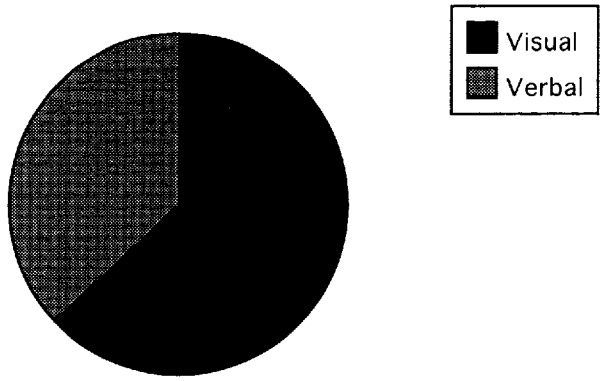
Student	Active	Reflective
1.		3
2.	7	
3.	5	
4.	3	
5.	1	
6.	3	
7.	3	
8.	1	
9.	7	
10.	1	
11.	5	
12.		7
13.	3	
14.	3	
15.	1	
16.	1	
17.	5	
18.		3
19.	1	
20.	3	
21.	7	
22.	7	
23.	3	
24.		5

Sensing Learners = 58%
Intuitive Learners = 42%



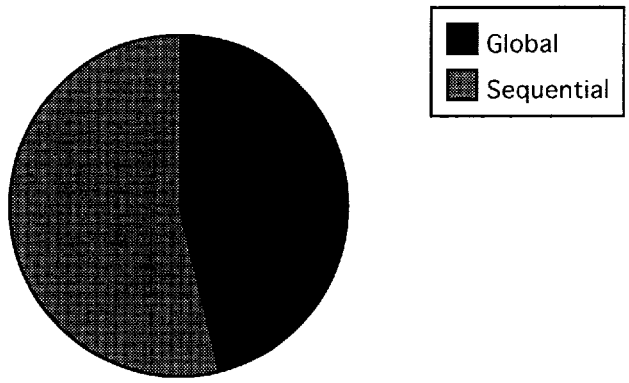
Student	Sensing	Intuitive
1.	1	
2.		1
3.		7
4.	7	
5.	7	
6.	9	
7.	5	
8.		3
9.		5
10.		3
11.	9	
12.		3
13.	9	
14.		5
15.	3	
16.	5	
17.		7
18.	1	
19.		3
20.	1	
21.	9	
22.		1
23.	5	
24.	3	

Visual Learners = 63%
Verbal Learners = 37%



Student	Visual	Verbal
1.		5
2.	9	
3.	9	
4.		3
5.	3	
6.	1	
7.		7
8.		1
9.	3	
10.		3
11.	7	
12.		5
13.	1	
14.		3
15.		5
16.	7	
17.	9	
18.		3
19.	5	
20.	1	
21.	9	
22.	9	
23.	3	
24.	3	

Global Learners = 46%
Sequential learners = 54%



Student	Sequential	Global
1.	9	
2.		1
3.	5	
4.	1	
5.		3
6.	3	
7.		1
8.	3	
9.		9
10.	7	
11.	5	
12.	9	
13.	3	
14.		5
15.	7	
16.		3
17.	3	
18.	7	
19.		7
20.		3
21.		5
22.		1
23.	1	
24.		3

Summarization of Individual Student Responses -Control Group

Student 1

Active	__3__	_____Reflective
Sensing	__9__	_____Intuitive
Visual	__5__	_____Verbal
Sequential	__5__	_____Global

Student 2

Active	__3__	_____Reflective
Sensing	__7__	_____Intuitive
Visual	_____	__3__Verbal
Sequential	__1__	_____Global

Student 3

Active	__5__	_____Reflective
Sensing	_____	__7__Intuitive
Visual	__9__	_____Verbal
Sequential	__3__	_____Global

Student 4

Active	_____	__5__Reflective
Sensing	__3__	_____Intuitive
Visual	__7__	_____Verbal
Sequential	_____	__3__Global

Student 5

Active	__3__	_____Reflective
Sensing	_____	__3__Intuitive
Visual	_____	__7__Verbal
Sequential	__3__	_____Global

Student 6

Active	__7__	_____Reflective
Sensing	_____	__5__Intuitive
Visual	__3__	_____Verbal
Sequential	_____	__9__Global

Student 7

Active	__1__	_____Reflective
Sensing	_____	__9__Intuitive

Visual	_____	__3__Verbal
Sequential	__3__	_____Global

Student 8

Active	__3__	_____Reflective
Sensing	_____	__5__Intuitive
Visual	__7__	_____Verbal
Sequential	_____	__5__Global

Student 9

Active	__1__	_____Reflective
Sensing	__3__	_____Intuitive
Visual	_____	__5__Verbal
Sequential	__7__	_____Global

Student 10

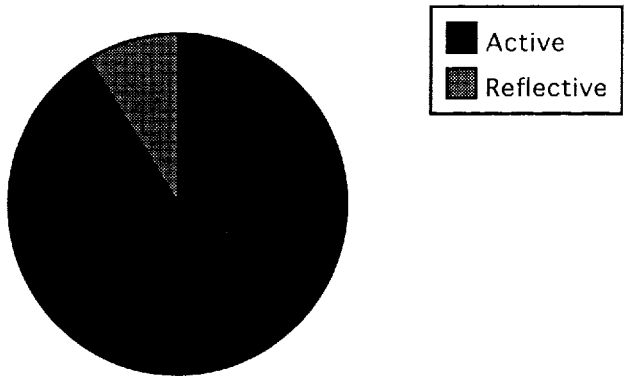
Active	__1__	_____Reflective
Sensing	__3__	_____Intuitive
Visual	__7__	_____Verbal
Sequential	_____	__7__Global

Student 11

Active	__5__	_____Reflective
Sensing	_____	__3__Intuitive
Visual	__5__	_____Verbal
Sequential	__3__	_____Global

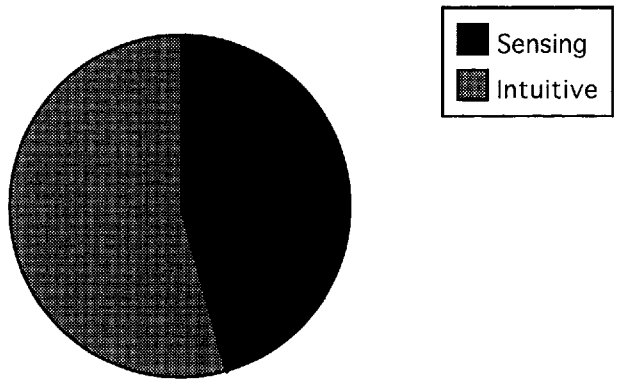
Summarization of data
Control Group

Active Learners = 91%
Reflective Learners = 9%



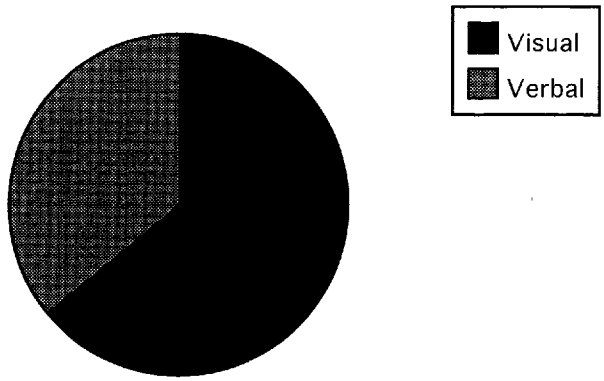
Student	Active	Reflective
1.	3	
2.	3	
3.	5	
4.		5
5.	3	
6.	7	
7.	1	
8.	3	
9.	1	
10.	1	
11.	5	

Sensing Learners = 45%
Intuitive Learners = 54%



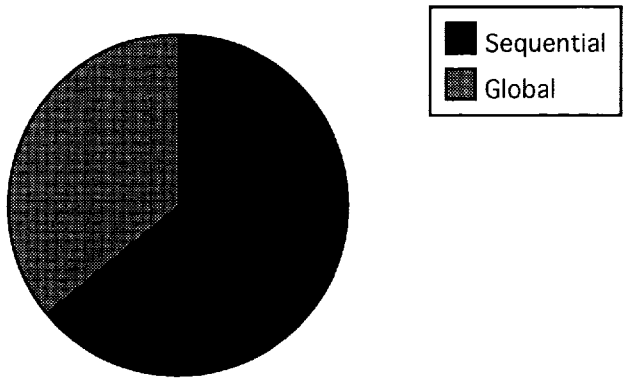
Student	Sensing	Intuitive
1.	9	
2.	7	
3.		7
4.	3	
5.		3
6.		5
7.		9
8.		5
9.	3	
10.	3	
11.		3

Visual Learners = 64%
Verbal Learners = 36%



Student	Visual	Verbal
1.	5	
2.		3
3.	9	
4.	7	
5.		7
6.	3	
7.		3
8.	7	
9.		5
10.	7	
11.	5	

Global Learners = 64%
Sequential learners = 36%

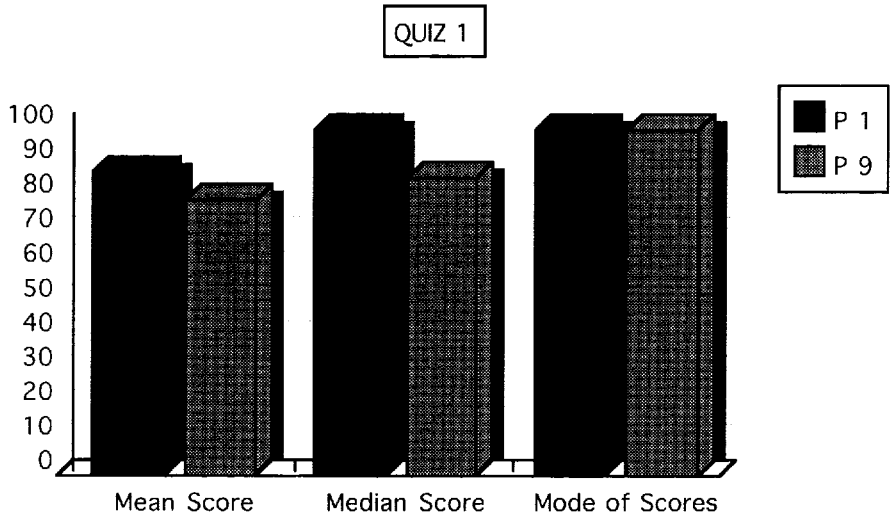


Student	Sequential	Global
1.	5	
2.	1	
3.	3	
4.		3
5.	3	
6.		9
7.	3	
8.		5
9.	7	
10.		7
11.	3	

Results of student quizzes

Quiz #1

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 100/100
Class Low = 25/100	Class Low = 0/100
Mean = 87.5	Mean = 80
Median = 100	Median = 86
Mode = 100	Mode = 100



Individual Student Scores - Quiz 1

Student (Period 1)	Student (Period 9)
1. 100	1. 100
2. 100	2. 75
3. 100	3. 85
4. 30	4. 100
5. 75	5. 0
6. 90	6. 90
7. 90	7. 85
8. 100	8. 90
9. 25	9. 100
10. 80	10. 86
11. 100	11. 85

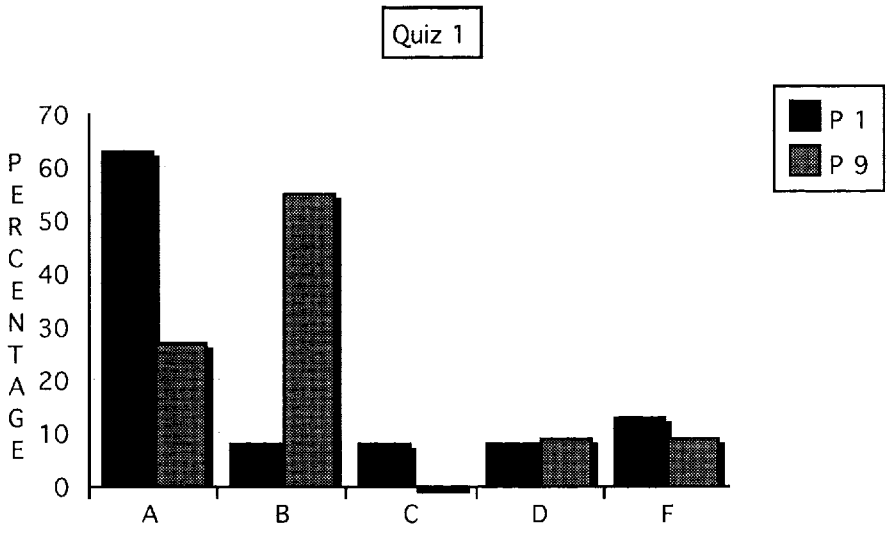
12. 100
13. 100
14. 100
15. 75
16. 100
17. 80
18. 100
19. 100
20. 100
21. 100
22. 100
23. 55
24. 100

Period 1

A (92-100)	= 63%
B (85-91)	= 08%
C (76-84)	= 08%
D (70-75)	= 08%
F (below-70)	= 13%

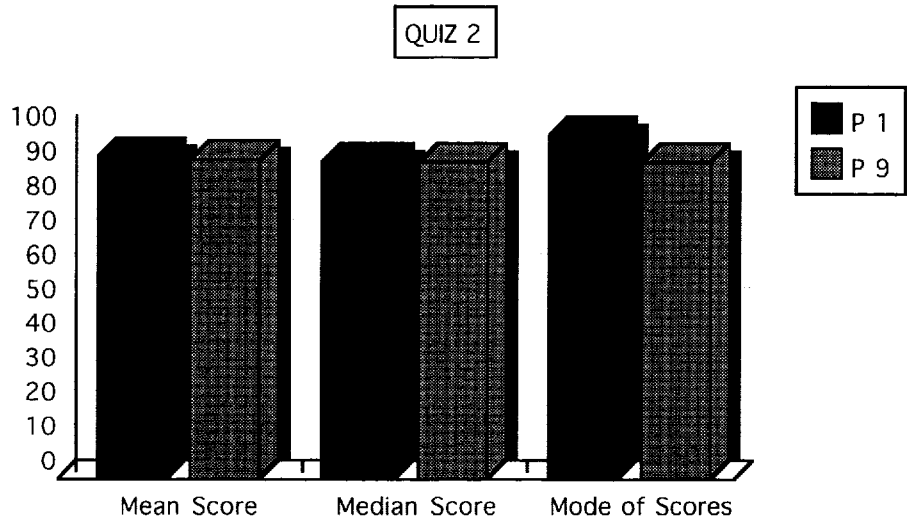
Period 9

A (92-100)	= 27%
B (85-91)	= 55%
C (76-84)	= 0%
D (70-75)	= 09%
F (below-70)	= 09%



Quiz #2

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 100/100
Class Low = 25/100	Class Low = 0/100
Mean = 87.5	Mean = 80
Median = 100	Median = 86
Mode = 100	Mode = 100



Individual Student Scores - Quiz 2

Student (Period 1)	Student (Period 9)
1. 100	1. 92
2. 100	2. 92
3. 88	3. 100
4. 100	4. 92
5. 90	5. 92
6. 88	6. 92
7. 100	7. 92
8. 88	8. 100
9. 90	9. 92
10. 100	10. 100
11. 88	11. 76

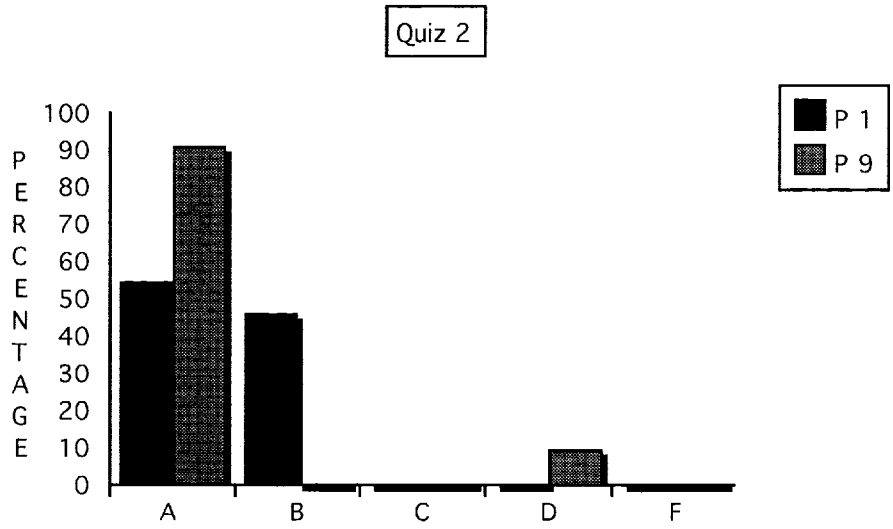
12. 92
13. 88
14. 90
15. 88
16. 100
17. 92
18. 100
19. 100
20. 100
21. 88
22. 100
23. 90
24. 100

Period 1

A (92-100)	= 54%
B (85-91)	= 46%
C (76-84)	= 0%
D (70-75)	= 0%
F (below-70)	= 0%

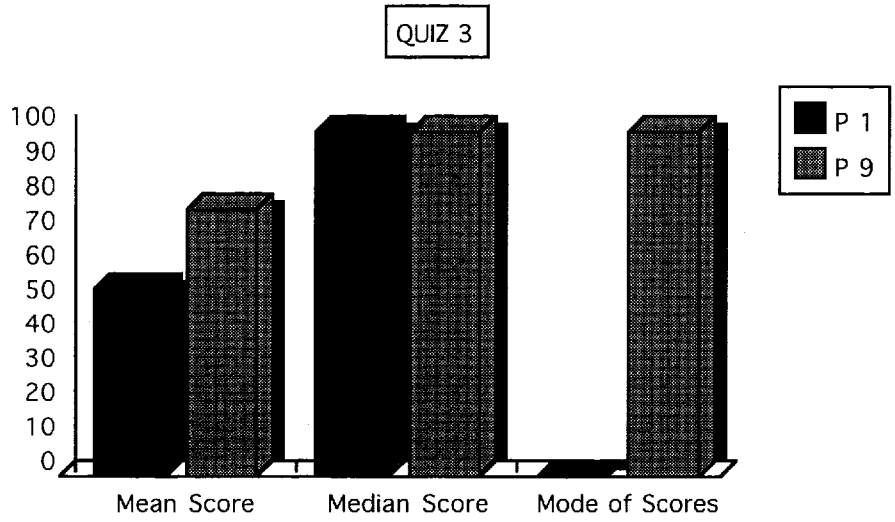
Period 9

A (92-100)	= 91%
B (85-91)	= 0%
C (76-84)	= 0%
D (70-75)	= 09%
F (below-70)	= 0%



Quiz #3

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 100/100
Class Low = 0/100	Class Low = 0/100
Mean = 55	Mean = 78
Median = 100	Median = 100
Mode = 0	Mode = 100



Individual Student Scores - Quiz 3

Student (Period 1)	Student (Period 9)
1. 0	1. 76
2. 100	2. 0
3. 100	3. 100
4. 0	4. 100
5. 0	5. 100
6. 0	6. 90
7. 0	7. 100
8. 0	8. 100
9. 75	9. 100
10. 0	10. 0
11. 0	11. 100
12. 100	

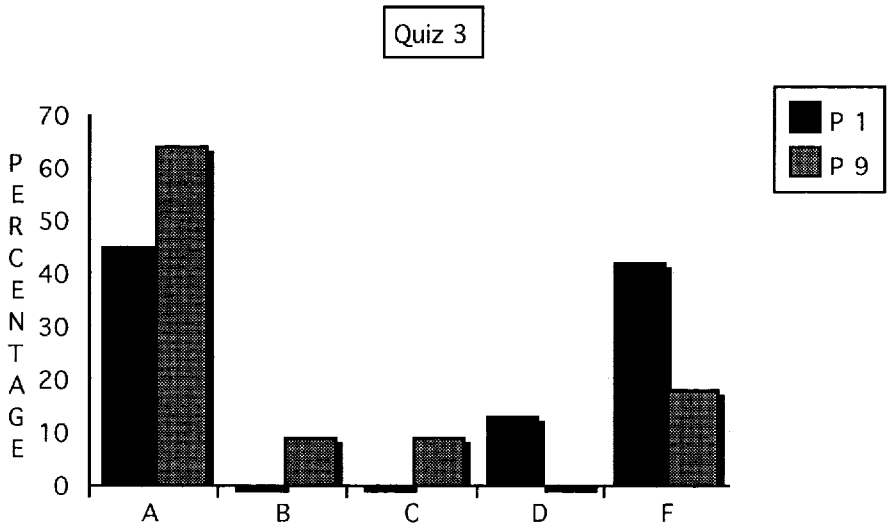
13. 100
14. 0
15. 75
16. 100
17. 0
18. 100
19. 100
20. 100
21. 0
22. 100
23. 100
24. 100

Period 1

A (92-100)	= 45%
B (85-91)	= 0%
C (76-84)	= 0%
D (70-75)	= 13%
F (below-70)	= 42%

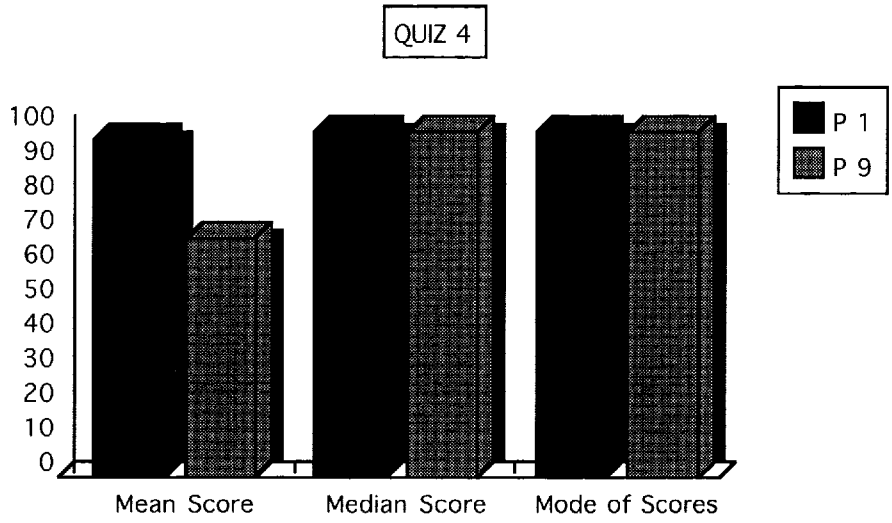
Period 9

A (92-100)	= 64%
B (85-91)	= 09%
C (76-84)	= 09%
D (70-75)	= 0%
F (below-70)	= 18%



Quiz #4

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 100/100
Class Low = 90/100	Class Low = 0/100
Mean = 97.4	Mean = 69.6
Median = 100	Median = 100
Mode = 100	Mode = 100



Individual Student Scores - Quiz 4

Student (Period 1)	Student (Period 9)
1. 92	1. 100
2. 100	2. 100
3. 100	3. 0
4. 100	4. 76
5. 100	5. 100
6. 100	6. 100
7. 100	7. 100
8. 100	8. 0
9. 90	9. 0
10. 100	10. 90
11. 92	11. 100
12. 100	

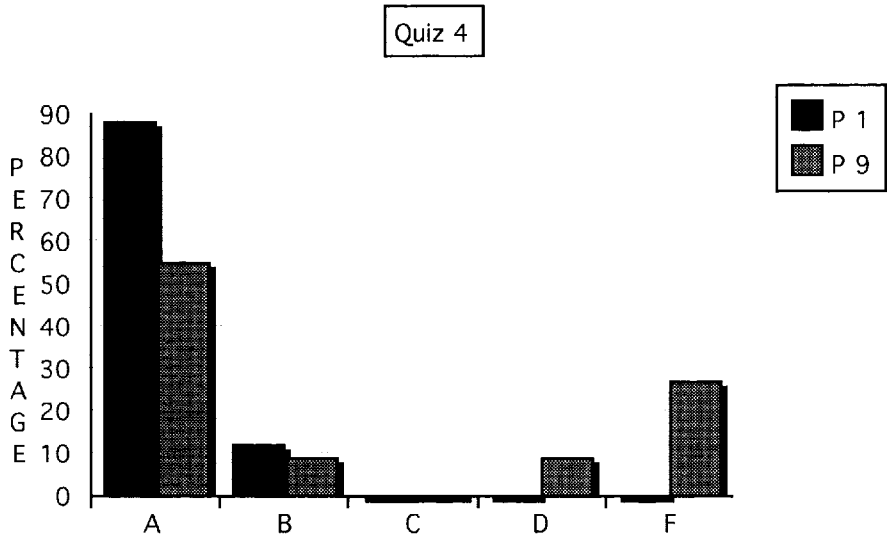
13. 100
14. 100
15. 92
16. 90
17. 100
18. 100
19. 100
20. 100
21. 92
22. 100
23. 90
24. 100

Period 1

A (92-100)	= 88%
B (85-91)	= 12%
C (76-84)	= 0%
D (70-75)	= 0%
F (below-70)	= 0%

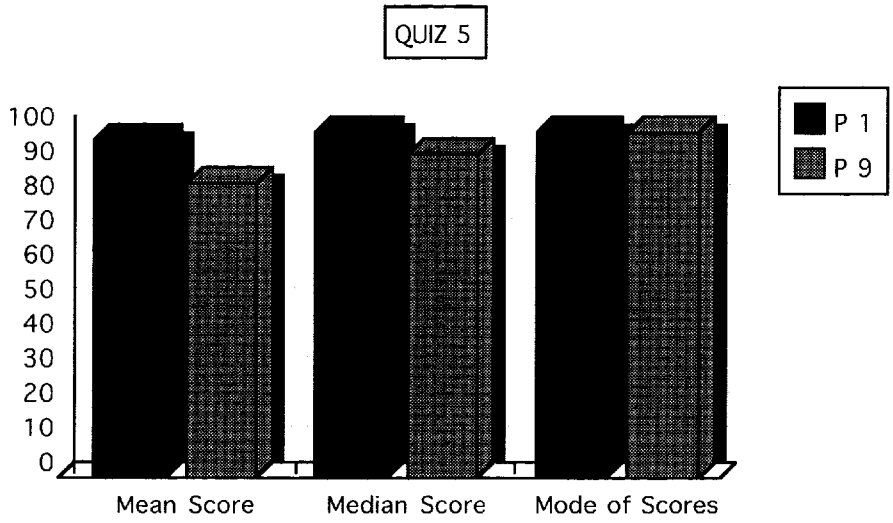
Period 9

A (92-100)	= 55%
B (85-91)	= 09%
C (76-84)	= 0%
D (70-75)	= 09%
F (below-70)	= 27%



Quiz #5

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 100/100
Class Low = 90/100	Class Low = 76/100
Mean = 97.8	Mean = 85.4
Median = 100	Median = 94
Mode = 100	Mode = 100



Individual Student Scores - Quiz 5

Student (Period 1)	Student (Period 9)
1. 100	1. 100
2. 100	2. 88
3. 100	3. 76
4. 100	4. 100
5. 100	5. 100
6. 92	6. 100
7. 100	7. 100
8. 100	8. 88
9. 92	9. 76
10. 100	10. 88
11. 100	11. 100
12. 92	

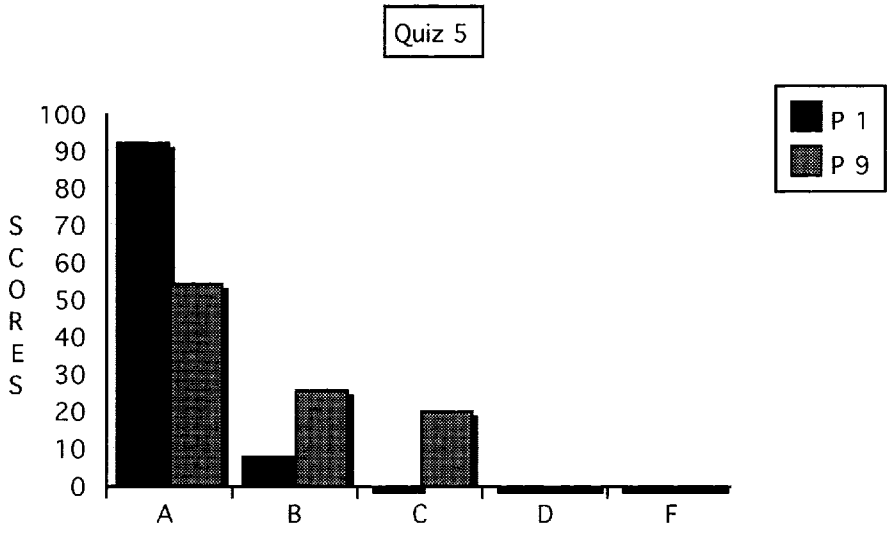
13. 100
14. 100
15. 90
16. 100
17. 90
18. 92
19. 100
20. 100
21. 100
22. 100
23. 100
24. 100

Period 1

A (92-100)	= 92%
B (85-91)	= 08%
C (76-84)	= 0%
D (70-75)	= 0%
F (below-70)	= 0%

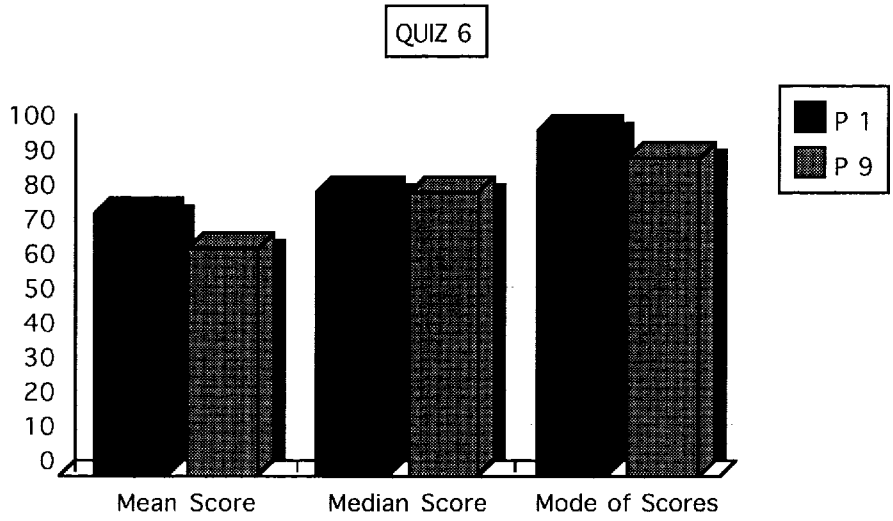
Period 9

A (92-100)	= 54%
B (85-91)	= 26%
C (76-84)	= 20%
D (70-75)	= 0%
F (below-70)	= 0%



Quiz #6

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 92/100
Class Low = 0/100	Class Low = 0/100
Mean = 76	Mean = 65.9
Median = 82	Median = 82
Mode = 100	Mode = 92



Individual Student Scores - Quiz 6

Student (Period 1)	Student (Period 9)
1. 80	1. 92
2. 100	2. 0
3. 85	3. 67
4. 60	4. 92
5. 82	5. 82
6. 68	6. 88
7. 89	7. 0
8. 0	8. 50
9. 88	9. 88
10. 72	10. 92
11. 100	11. 74
12. 100	

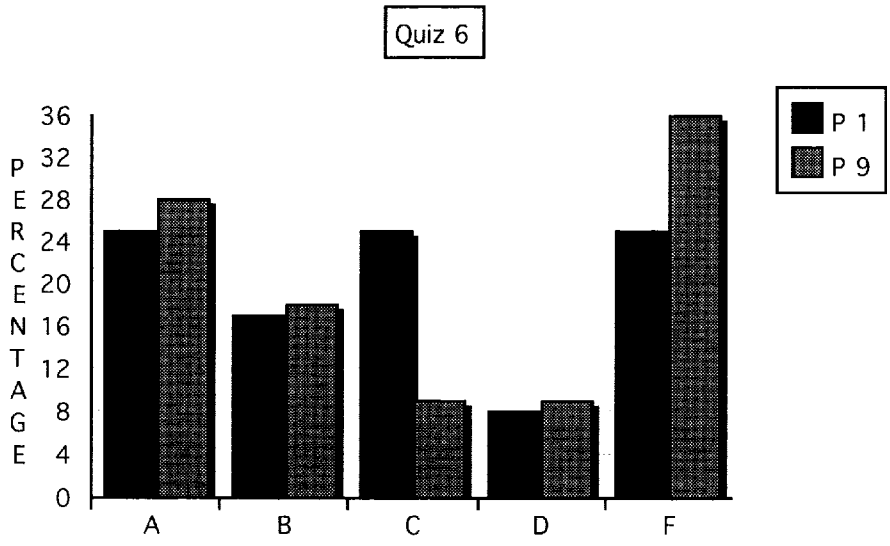
13. 88
14. 80
15. 80
16. 72
17. 100
18. 100
19. 100
20. 55
21. 0
22. 78
23. 100
24. 82

Period 1

A (92-100)	= 25%
B (85-91)	= 17%
C (76-84)	= 25%
D (70-75)	= 08%
F (below-70)	= 25%

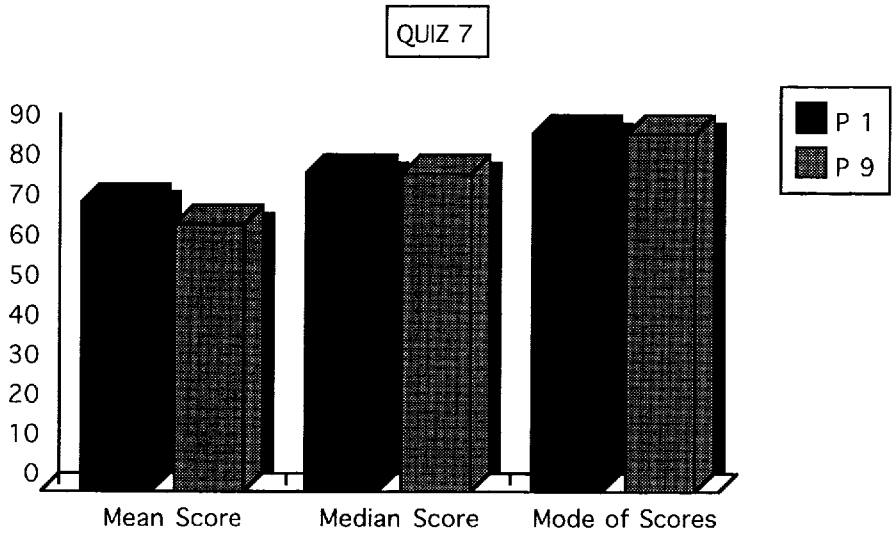
Period 9

A (92-100)	= 28%
B (85-91)	= 18%
C (76-84)	= 09%
D (70-75)	= 09%
F (below-70)	= 36%



Quiz #7

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 90/100
Class Low = 30/100	Class Low = 0/100
Mean = 72.9	Mean = 67.2
Median = 80	Median = 80
Mode = 90	Mode = 90



Individual Student Scores - Quiz 7

Student (Period 1)	Student (Period 9)
1. 90	1. 90
2. 90	2. 0
3.90	3. 70
4. 30	4. 90
5. 60	5. 90
6. 50	6. 80
7. 100	7. 0
8. 80	8. 90
9. 70	9. 70
10. 90	10. 90
11. 70	11. 70

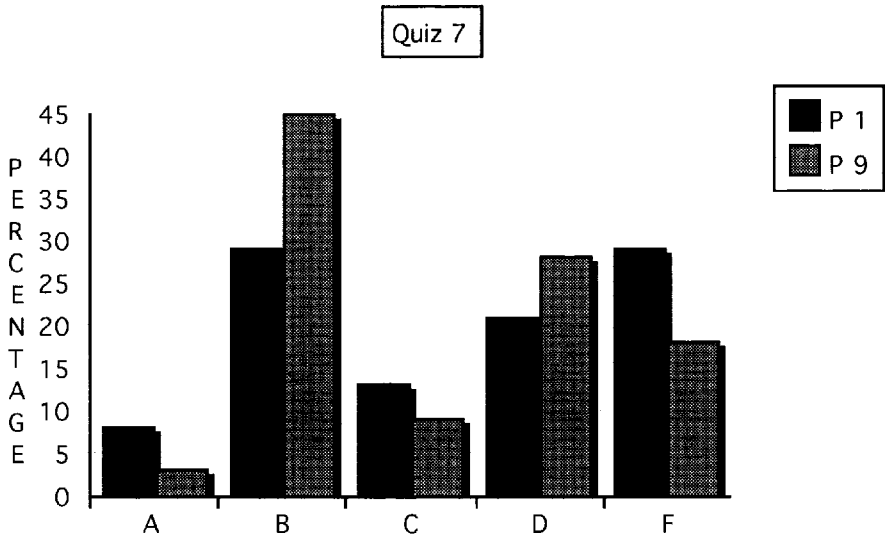
12. 90
13. 80
14. 90
15. 90
16. 70
17. 60
18. 50
19. 80
20. 100
21. 30
22. 70
23. 50
24. 70

Period 1

A (92-100)	= 08%
B (85-91)	= 29%
C (76-84)	= 13%
D (70-75)	= 21%
F (below-70)	= 29%

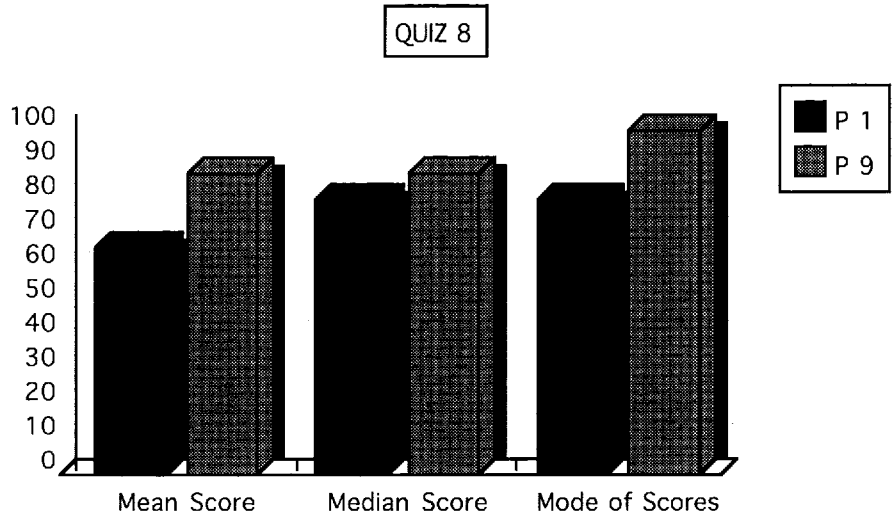
Period 9

A (92-100)	= 03%
B (85-91)	= 45%
C (76-84)	= 09%
D (70-75)	= 28%
F (below-70)	= 18%



Quiz #8

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 100/100
Class Low = 0/100	Class Low = 70/100
Mean = 65.8	Mean = 87.5
Median = 80	Median = 88
Mode = 80	Mode = 100



Individual Student Scores - Quiz 8

Student (Period 1)	Student (Period 9)
1. 100	1. 90
2. 100	2. 72
3. 80	3. 85
4. 0	4. 70
5. 85	5. 100
6. 80	6. 100
7. 55	7. 90
8. 100	8. 88
9. 50	9. 88
10. 80	10. 100
11. 90	11. 80

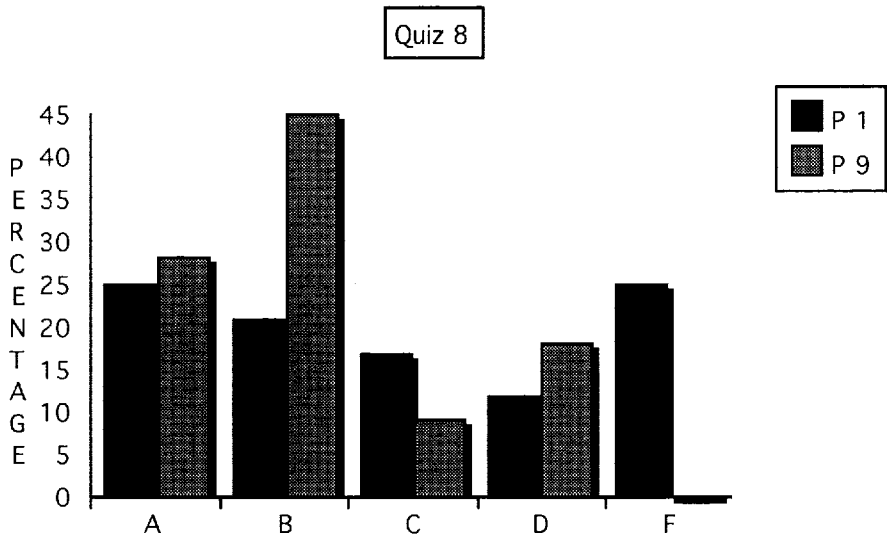
12. 95
13. 95
14. 0
15. 95
16. 85
17. 72
18. 70
19. 90
20. 85
21. 0
22. 0
23. 70
24. 84

Period 1

A (92-100)	= 25%
B (85-91)	= 21%
C (76-84)	= 17%
D (70-75)	= 12%
F (below-70)	= 25%

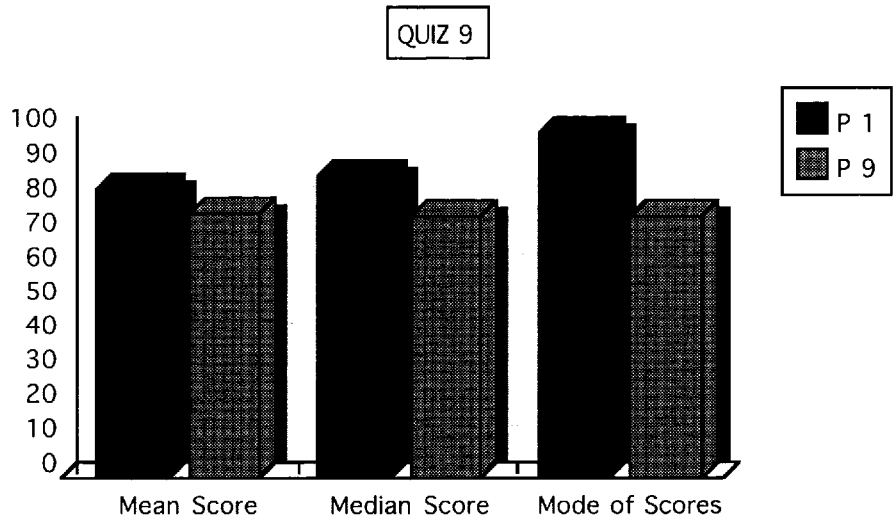
Period 9

A (92-100)	= 28%
B (85-91)	= 45%
C (76-84)	= 09%
D (70-75)	= 18%
F (below-70)	= 0%



Quiz #9

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 100/100
Class Low = 0/100	Class Low = 0/100
Mean = 83.9	Mean = 76.9
Median = 88	Median = 76
Mode = 100	Mode = 76



Individual Student Scores - Quiz 9

Student (Period 1)	Student (Period 9)
1. 100	1. 0
2. 100	2. 76
3. 90	3. 76
4. 88	4. 88
5. 88	5. 100
6. 88	6. 100
7. 86	7. 92
8. 100	8. 70
9. 84	9. 92
10. 0	10. 76
11. 100	11. 76
12. 100	

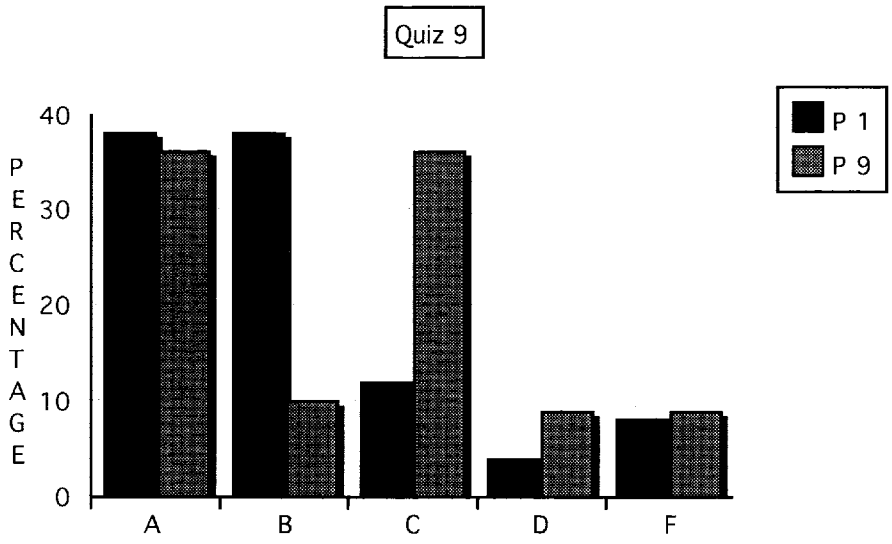
13. 84
14. 90
15. 72
16. 100
17. 86
18. 88
19. 100
20. 100
21. 0
22. 100
23. 90
24. 80

Period 1

A (92-100)	= 38%
B (85-91)	= 38%
C (76-84)	= 12%
D (70-75)	= 04%
F (below-70)	= 08%

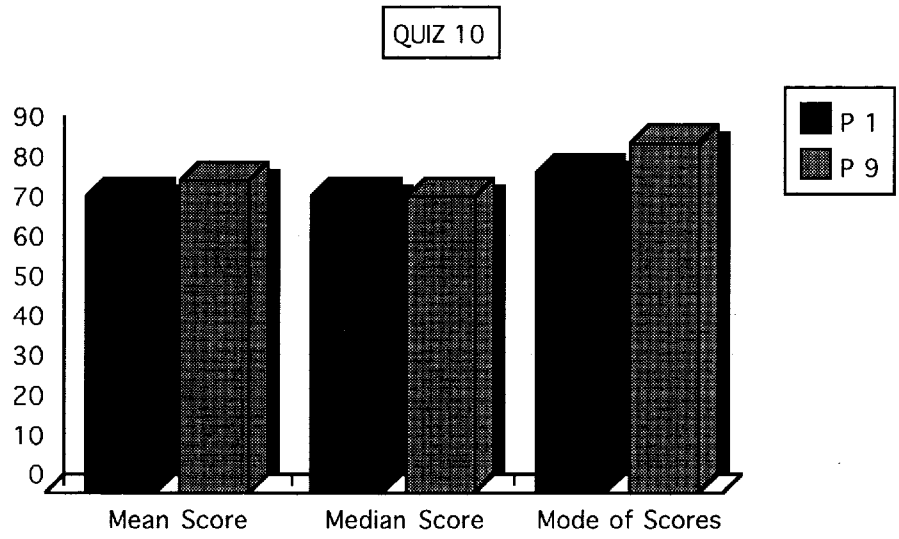
Period 9

A (92-100)	= 36%
B (85-91)	= 10%
C (76-84)	= 36%
D (70-75)	= 09%
F (below-70)	= 09%



Quiz #10

Period 1(Experimental)	Period 9 (Control)
Class High = 94/100	Class High = 100/100
Class Low = 50/100	Class Low = 56/100
Mean = 74.9	Mean = 78.9
Median = 75	Median = 75
Mode = 81	Mode = 88



Individual Student Scores - Quiz 10

Student (Period 1)	Student (Period 9)
1. 88	1. 75
2. 88	2. 88
3. 89	3. 70
4. 76	4. 88
5. 70	5. 100
6. 70	6. 75
7. 70	7. 88
8. 56	8. 70
9. 50	9. 56
10. 63	10. 88
11. 81	11. 70

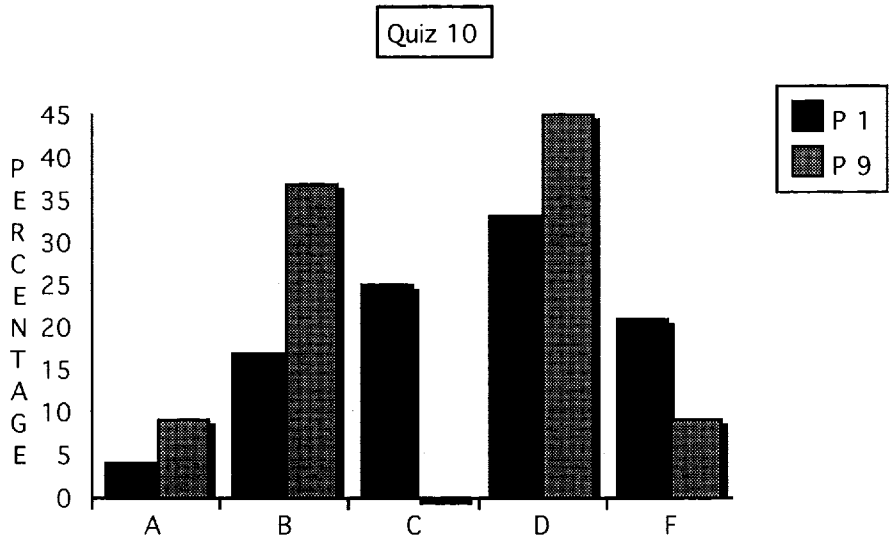
12. 75
13. 89
14. 94
15. 63
16. 81
17. 75
18. 81
19. 75
20. 75
21. 70
22. 76
23. 63
24. 81

Period 1

A (92-100)	= 04%
B (85-91)	= 17%
C (76-84)	= 25%
D (70-75)	= 33%
F (below-70)	= 21%

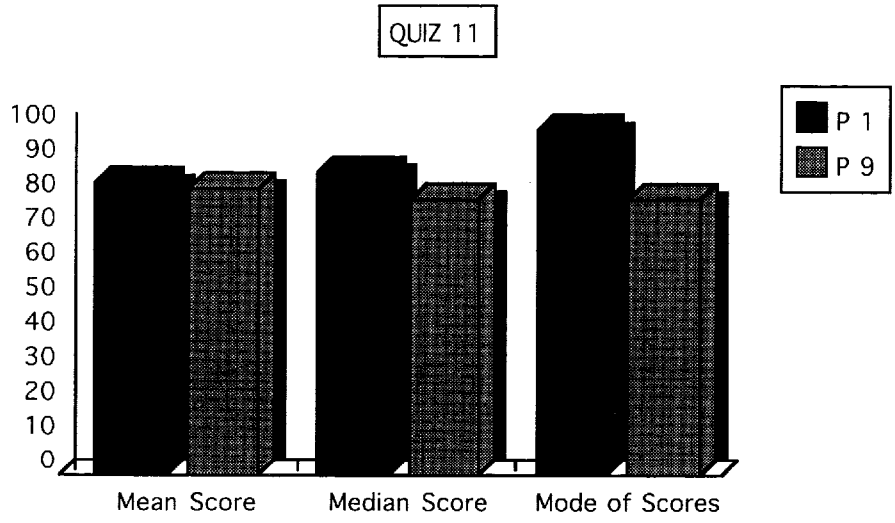
Period 9

A (92-100)	= 09%
B (85-91)	= 37%
C (76-84)	= 0%
D (70-75)	= 45%
F (below-70)	= 09%



Quiz #11

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 100/100
Class Low = 0/100	Class Low = 70/100
Mean = 85	Mean = 82.8
Median = 88	Median = 80
Mode = 100	Mode = 80



Individual Student Scores - Quiz 11

Student (Period 1)	Student (Period 9)
1. 100	1. 100
2. 100	2. 80
3. 70	3. 85
4. 100	4. 88
5. 85	5. 80
6. 88	6. 100
7. 70	7. 70
8. 80	8. 80
9. 85	9. 88
10. 70	10. 70
11. 100	11. 80

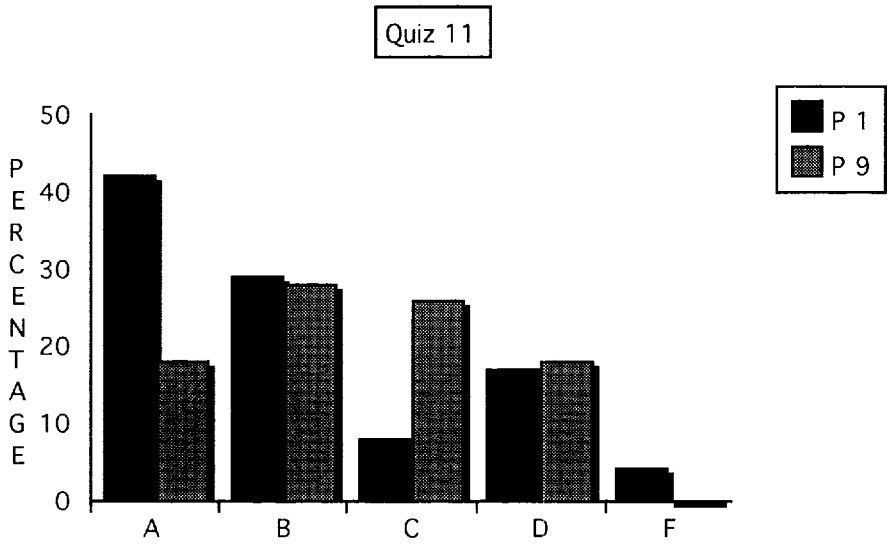
12. 88
13. 100
14. 0
15. 100
16. 100
17. 80
18. 90
19. 95
20. 90
21. 70
22. 88
23. 94
24. 100

Period 1

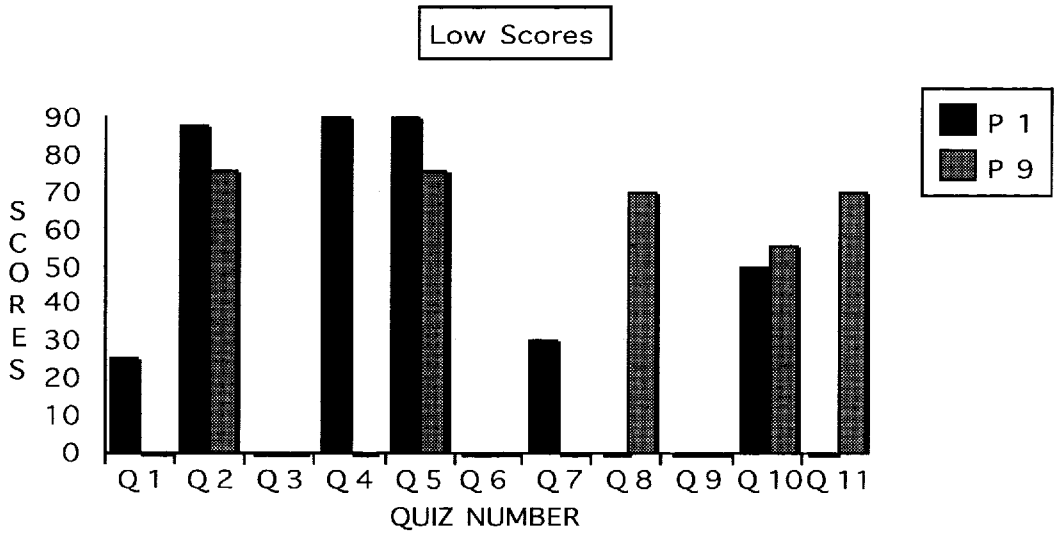
A (92-100)	= 42%
B (85-91)	= 29%
C (76-84)	= 08%
D (70-75)	= 17%
F (below-70)	= 04%

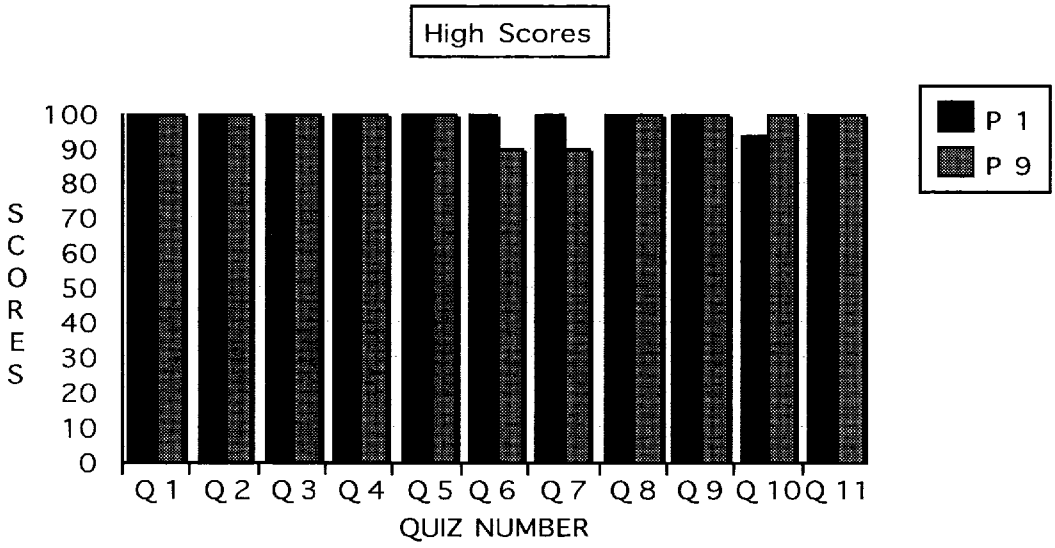
Period 9

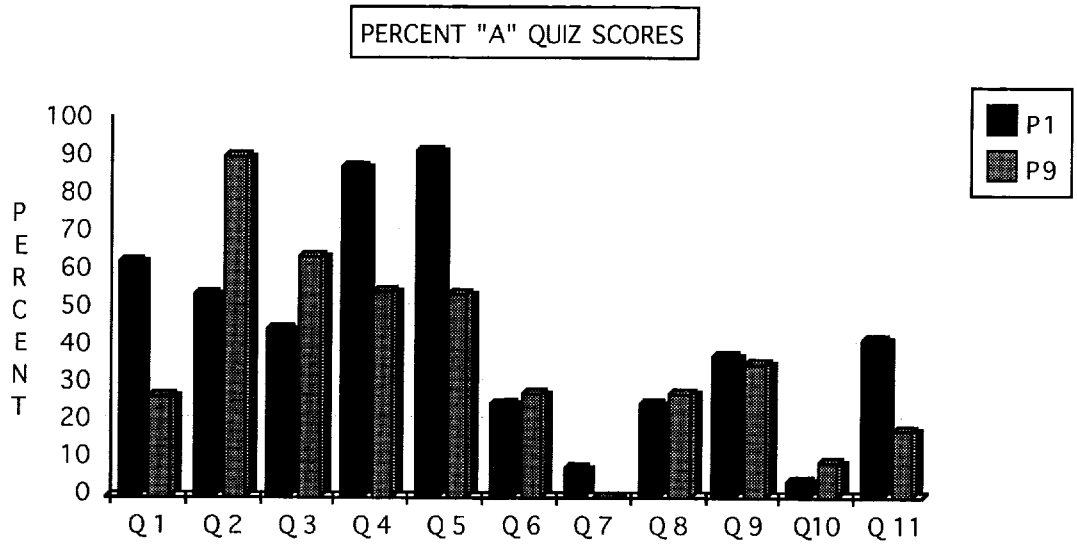
A (92-100)	= 18%
B (85-91)	= 28%
C (76-84)	= 36%
D (70-75)	= 18%
F (below-70)	= 0%

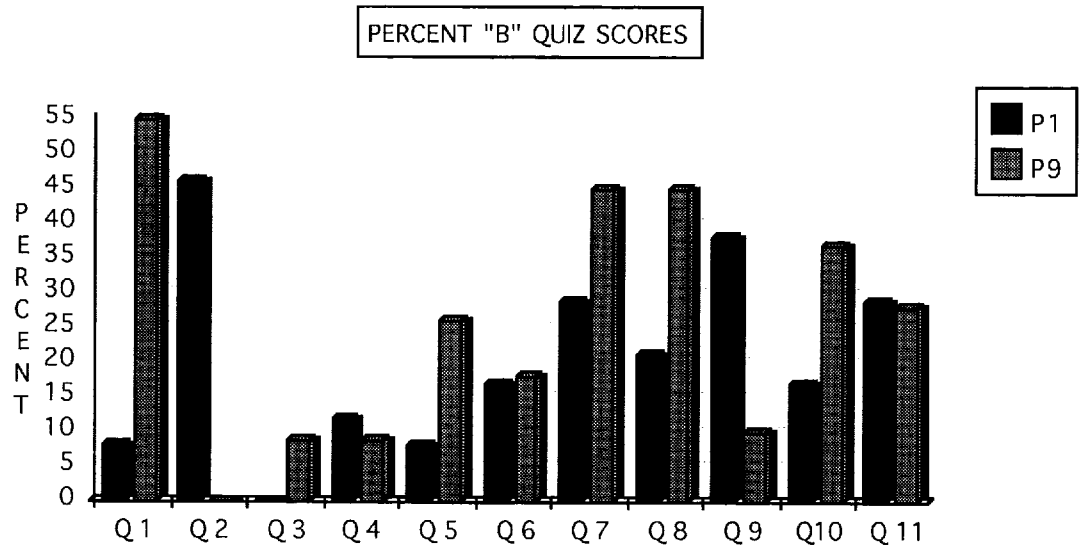


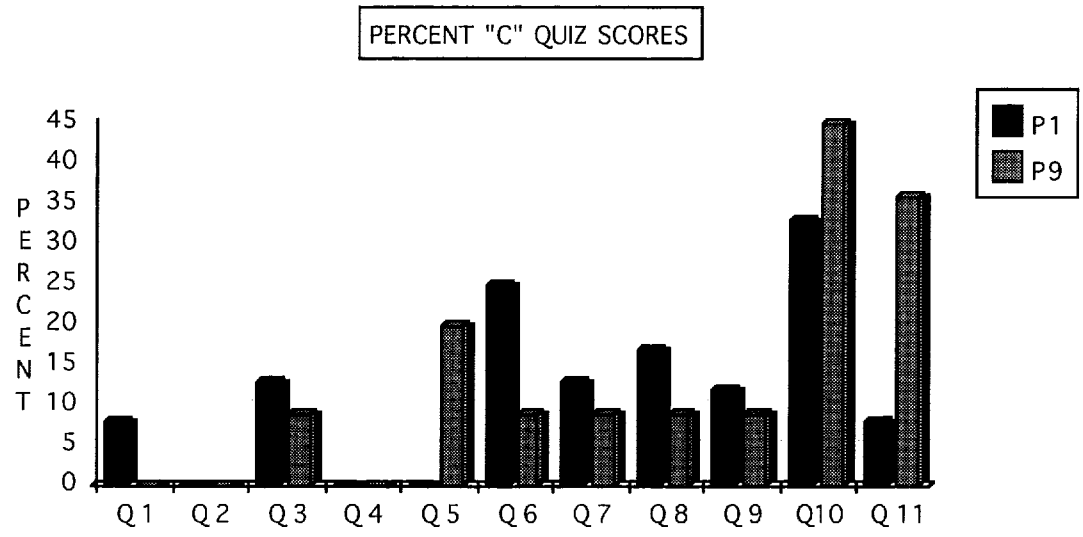
Comparison of quiz results

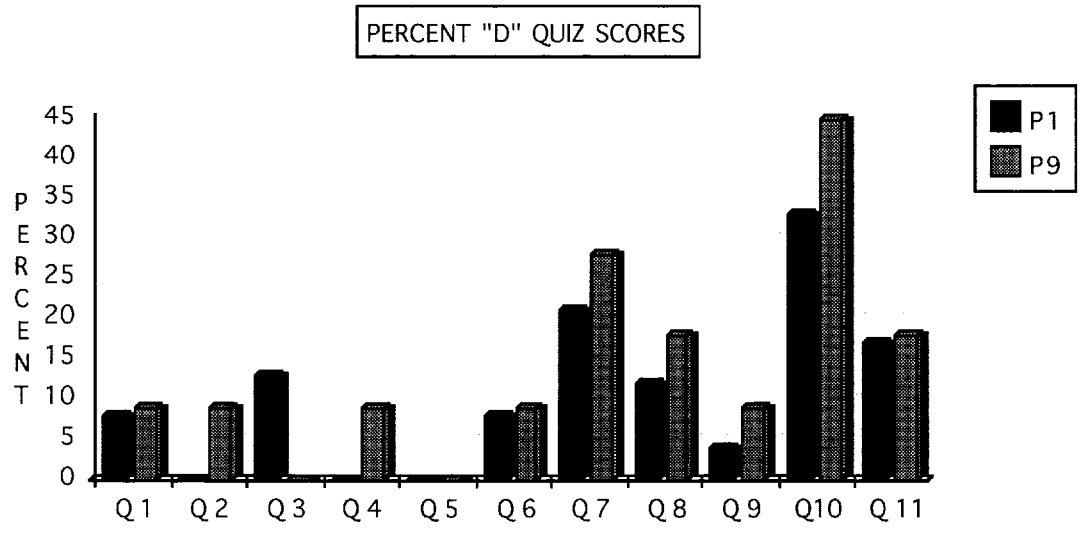


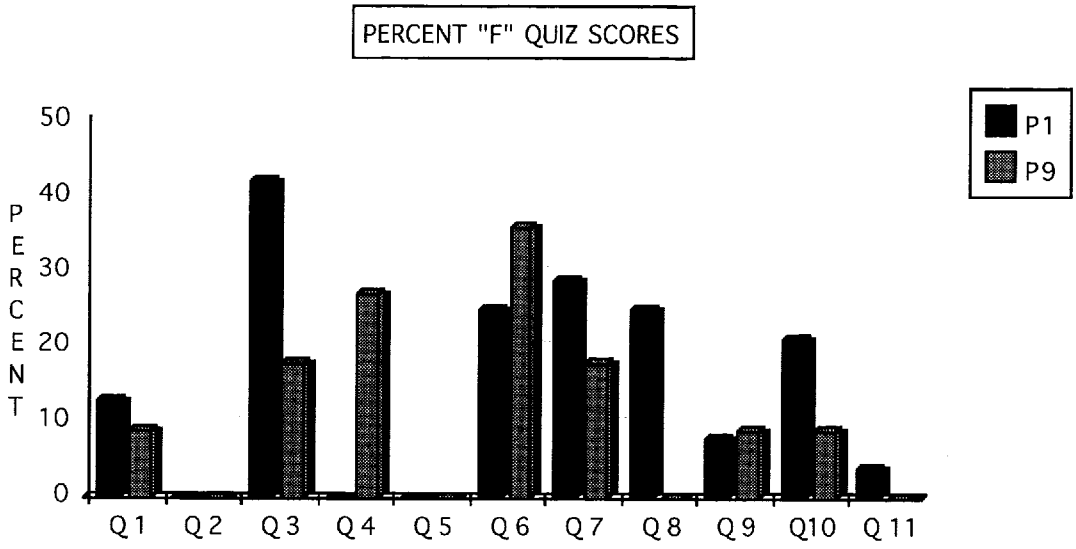



PERCENT "A" QUIZ SCORES
P1
P9
PERCENT
100
90
80
70
60
50
40
30
20
10
0
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11


PERCENT "B" QUIZ SCORES
P1
P9
PERCENT
55
50
45
40
35
30
25
20
15
10
5
0
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11


PERCENT "C" QUIZ SCORES
PERCENT
45
40
35
30
25
20
15
10
5
0
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11
P1
P9

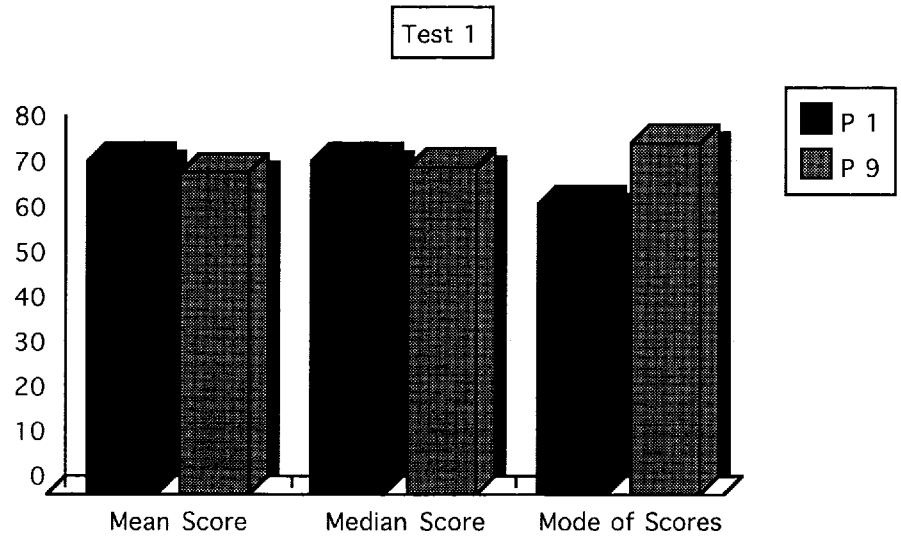

PERCENT "D" QUIZ SCORES
PERCENT
45
40
35
30
25
20
15
10
5
0
Q1 Q2 Q3 Q4 Q5 Q6 Q7 Q8 Q9 Q10 Q11
P1
P9


PERCENT "F" QUIZ SCORES
P1
P9
PERCENT
50
40
30
20
10
0
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11

Results of student tests

Test #1

Period 1(Experimental)	Period 9 (Control)
Class High = 93/100	Class High = 86/100
Class Low = 58/100	Class Low = 52/100
Mean = 74	Mean = 71.6
Median = 74	Median = 73
Mode = 65	Mode = 78



Individual Student Scores - Test 1

Student (Period 1)	Student (Period 9)
1. 77	1. 70
2. 93	2. 86
3. 70	3. 73
4. 58	4. 86
5. 65	5. 52
6. 62	6. 63
7. 65	7. 78
8. 73	8. 78
9. 62	9. 57

10. 62
11. 85
12. 85
13. 92
14. 83
15. 58
16. 77
17. 60
18. 67
19. 90
20. 87
21. 87
22. 74
23. 65
24. 86

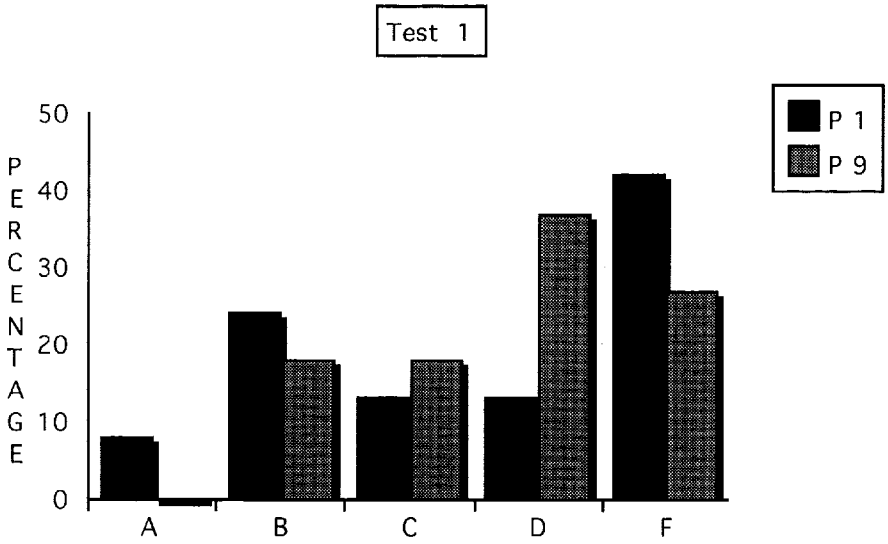
10. 70
11. 75

Period 1

A (92-100)	= 08%
B (85-91)	= 25%
C (76-84)	= 13%
D (70-75)	= 13%
F (below-70)	= 42%

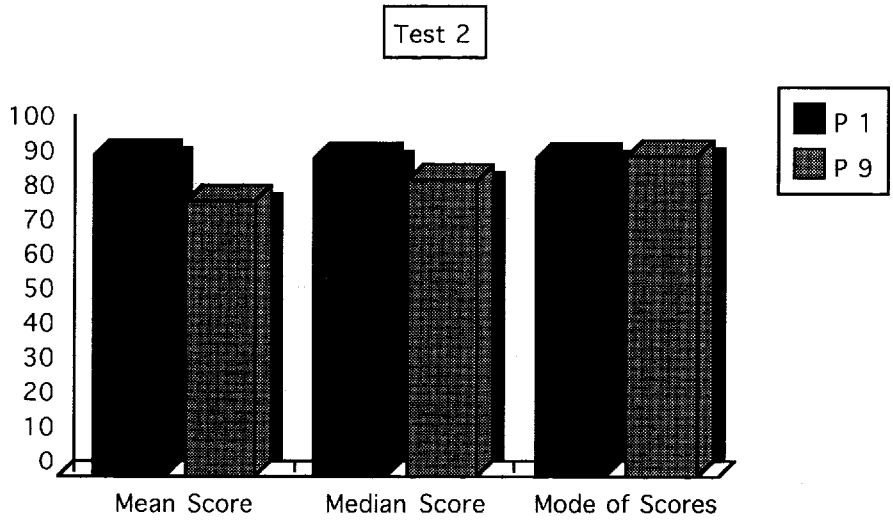
Period 9

A (92-100)	= 0%
B (85-91)	= 18%
C (76-84)	= 18%
D (70-75)	= 37%
F (below-70)	= 27%



Test #2

Period 1(Experimental)	Period 9 (Control)
Class High = 100/100	Class High = 95/100
Class Low = 70/100	Class Low = 52/100
Mean = 93	Mean = 80
Median = 92	Median = 86
Mode = 92	Mode = 93



Individual Student Scores - Test 2

Student (Period 1)	Student (Period 9)
1. 94	1. 65
2. 100	2. 86
3. 96	3. 93
4. 90	4. 87
5. 90	5. 93
6. 96	6. 52
7. 100	7. 73
8. 96	8. 75
9. 90	9. 95
10. 100	10. 76
11. 90	11. 88

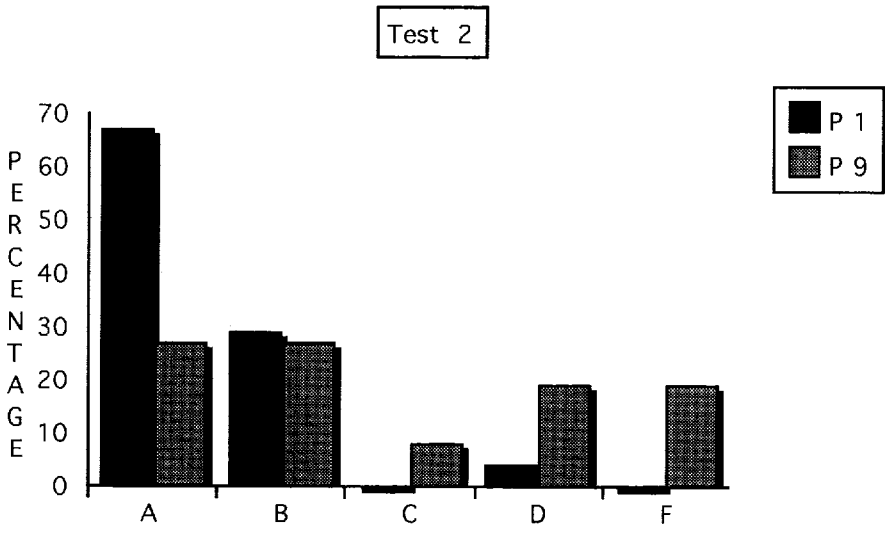
12. 92
13. 100
14. 70
15. 90
16. 90
17. 92
18. 92
19. 96
20. 100
21. 92
22. 100
23. 92
24. 88

Period 1

A (92-100)	= 67%
B (85-91)	= 29%
C (76-84)	= 0%
D (70-75)	= 04%
F (below-70)	= 0%

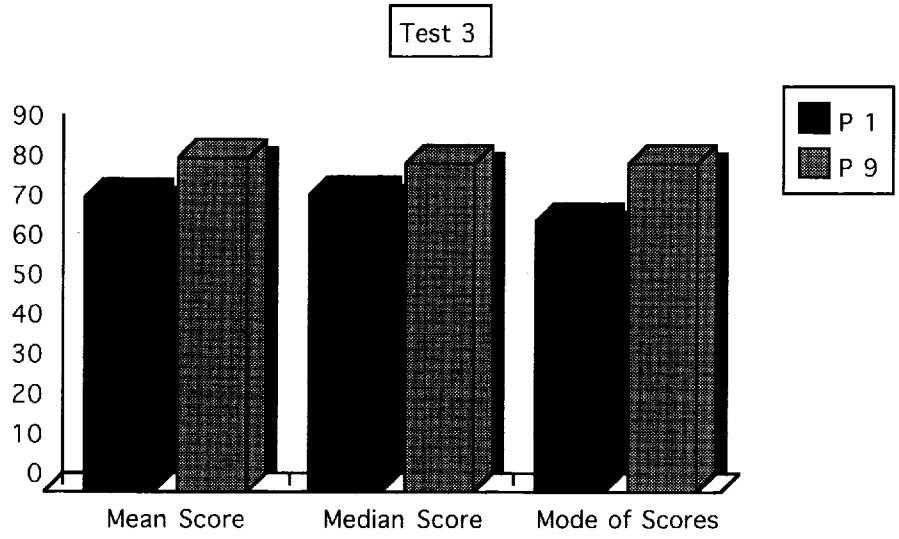
Period 9

A (92-100)	= 27%
B (85-91)	= 27%
C (76-84)	= 08%
D (70-75)	= 19%
F (below-70)	= 19%



Test #3

Period 1(Experimental)	Period 9 (Control)
Class High = 95/100	Class High = 95/100
Class Low = 57/100	Class Low = 52/100
Mean = 74	Mean = 84
Median = 75	Median = 83
Mode = 68	Mode = 83



Individual Student Scores - Test 3

Student (Period 1)	Student (Period 9)
1. 88	1. 83
2. 93	2. 80
3. 73	3. 92
4. 75	4. 80
5. 68	5. 83
6. 72	6. 87
7. 68	7. 92
8. 88	8. 82
9. 57	9. 86
10. 88	10. 84
11. 83	11. 83

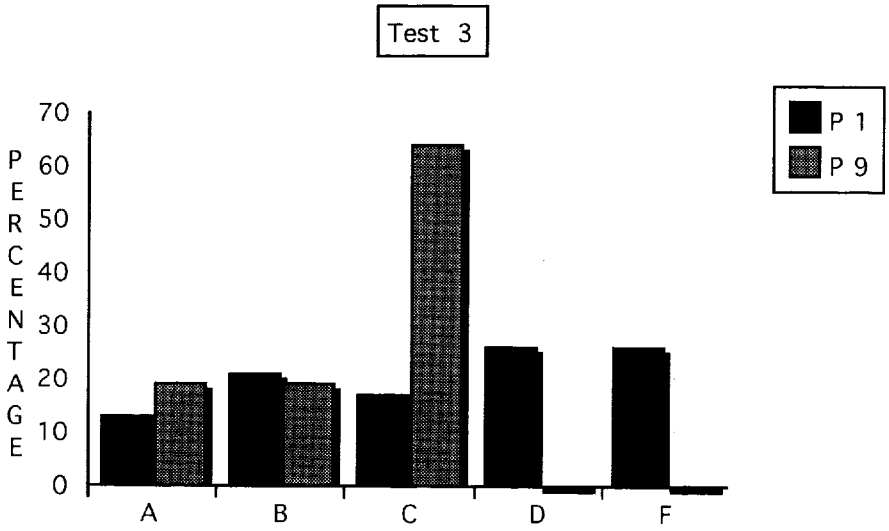
12. 88
13. 83
14. 92
15. 68
16. 72
17. 75
18. 58
19. 95
20. 85
21. 80
22. 60
23. 70
24. 84

Period 1

A (92-100)	= 13%
B (85-91)	= 21%
C (76-84)	= 17%
D (70-75)	= 26%
F (below-70)	= 26%

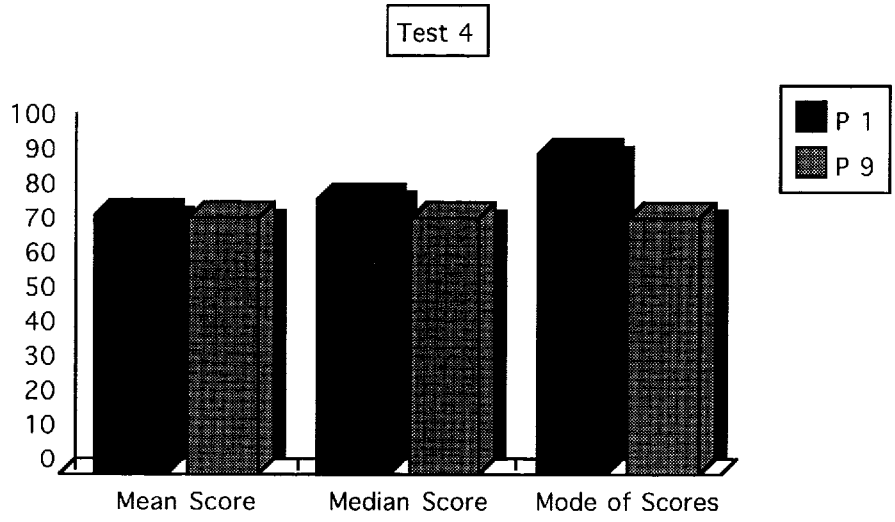
Period 9

A (92-100)	= 18%
B (85-91)	= 18%
C (76-84)	= 64%
D (70-75)	= 0%
F (below-70)	= 0%



Test #4

Period 1(Experimental)	Period 9 (Control)
Class High = 97/100	Class High = 88/100
Class Low = 60/100	Class Low = 65/100
Mean = 75.7	Mean = 75
Median = 80	Median = 75
Mode = 93	Mode = 75



Individual Student Scores - Test 4

Student (Period 1)	Student (Period 9)
1. 78	1. 75
2. 97	2. 70
3. 77	3. 72
4. 63	4. 77
5. 77	5. 73
6. 73	6. 72
7. 87	7. 88
8. 83	8. 65
9. 67	9. 82
10. 85	10. 76
11. 88	11. 75

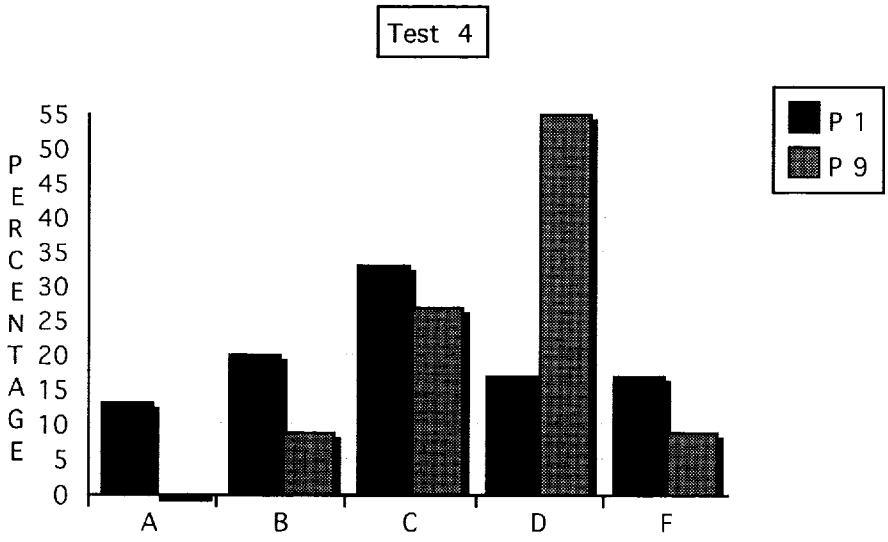
12. 80
13. 92
14. 80
15. 72
16. 92
17. 60
18. 75
19. 90
20. 83
21. 92
22. 70
23. 63
24. 85

Period 1

A (92-100)	= 13%
B (85-91)	= 20%
C (76-84)	= 33%
D (70-75)	= 17%
F (below-70)	= 17%

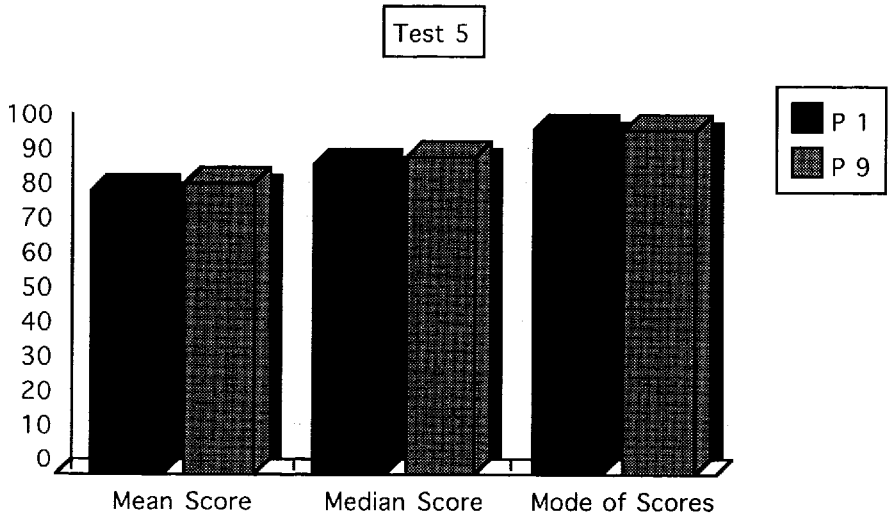
Period 9

A (92-100)	= 0%
B (85-91)	= 09%
C (76-84)	= 27%
D (70-75)	= 55%
F (below-70)	= 09%



Test #5

Period 1(Experimental)	Period 9 (Control)
Class High =100/100	Class High = 100/100
Class Low = 0/100	Class Low = 0/100
Mean = 82	Mean = 85
Median = 90	Median = 92
Mode = 100	Mode = 100



Individual Student Scores - Test 5

Student (Period 1)	Student (Period 9)
1. 85	1. 100
2. 100	2. 92
3. 100	3. 100
4. 88	4. 92
5. 90	5. 100
6. 75	6. 0
7. 75	7. 85
8. 0	8. 100
9. 90	9. 100
10. 96	10. 82
11. 50	11. 85

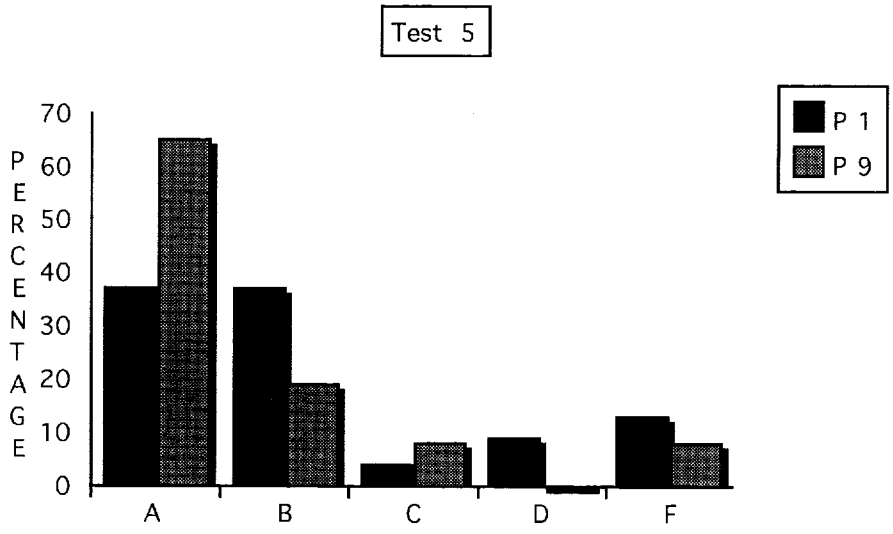
12. 85
13. 85
14. 75
15 . 100
16. 100
17. 100
18. 88
19. 90
20. 100
21. 0
22. 100
23. 90
24. 84

Period 1

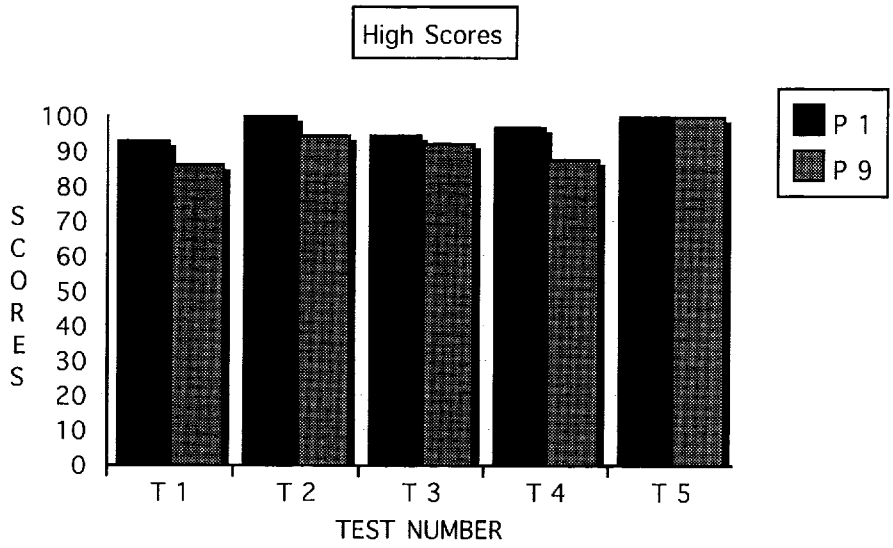
A (92-100)	= 37%
B (85-91)	= 37%
C (76-84)	= 04%
D (70-75)	= 09%
F (below-70)	= 13%

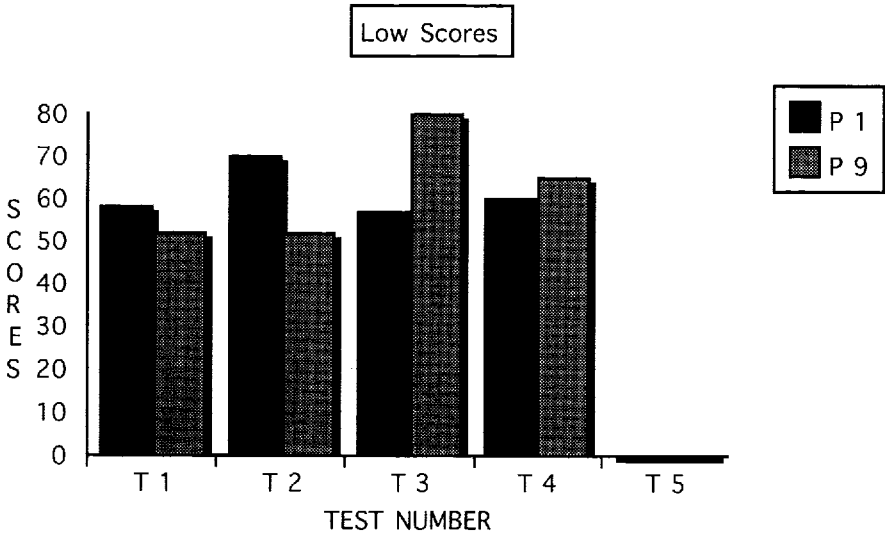
Period 9

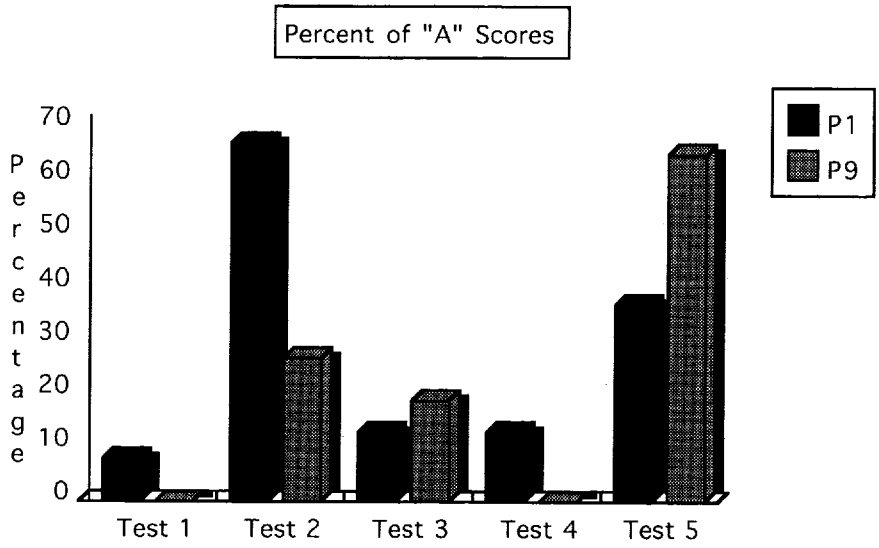
A (92-100)	= 65%
B (85-91)	= 19%
C (76-84)	= 08%
D (70-75)	= 0%
F (below-70)	= 08%

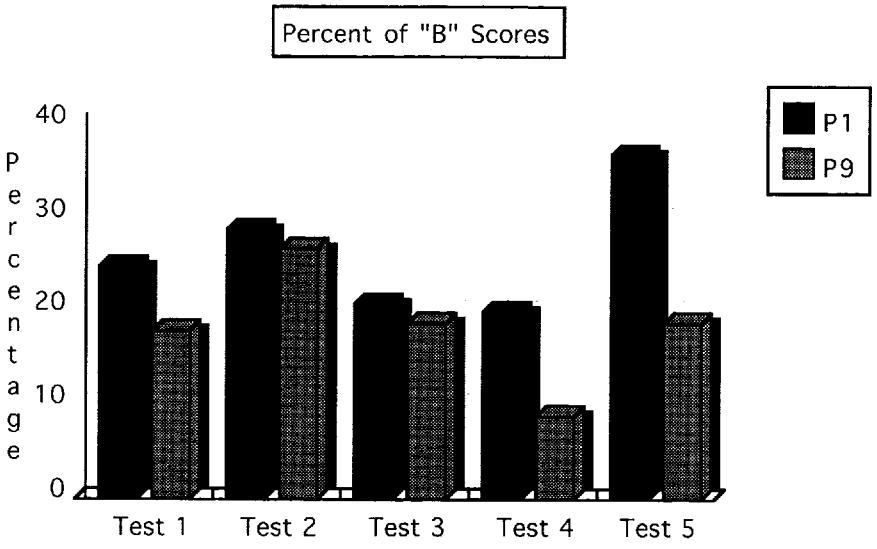


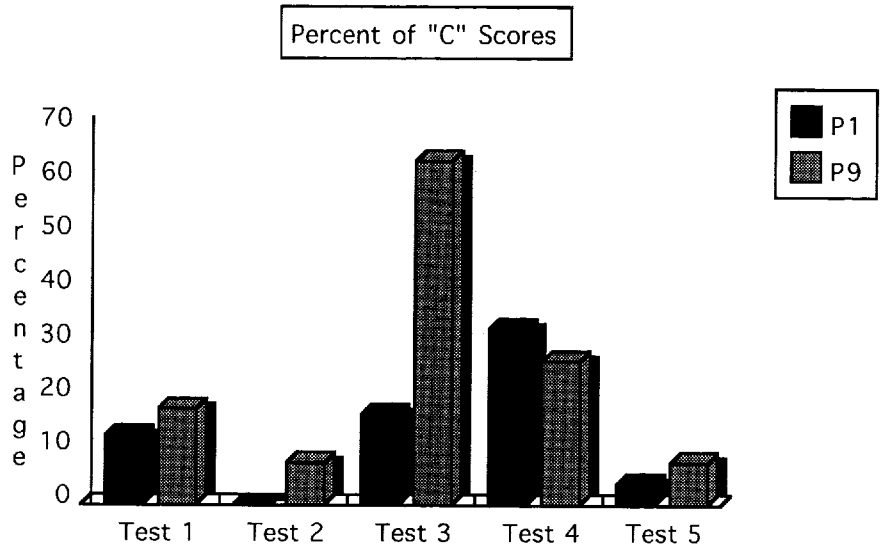
Comparison of test results

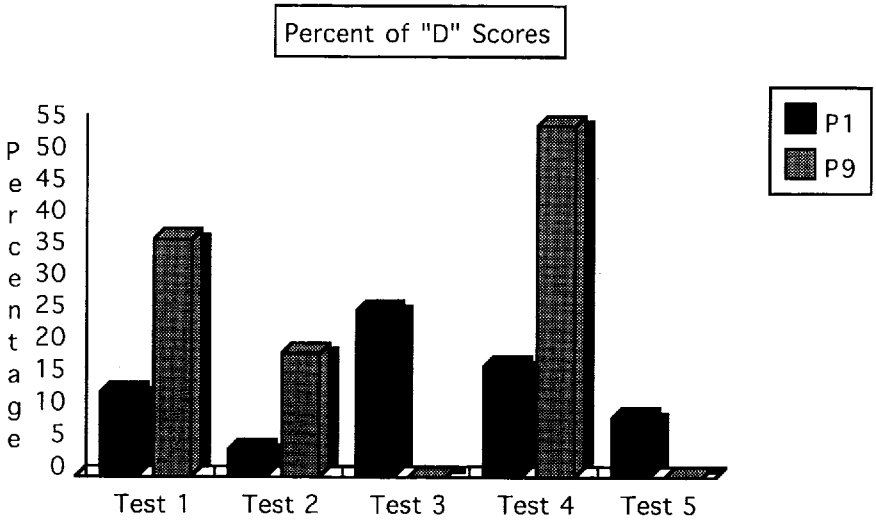


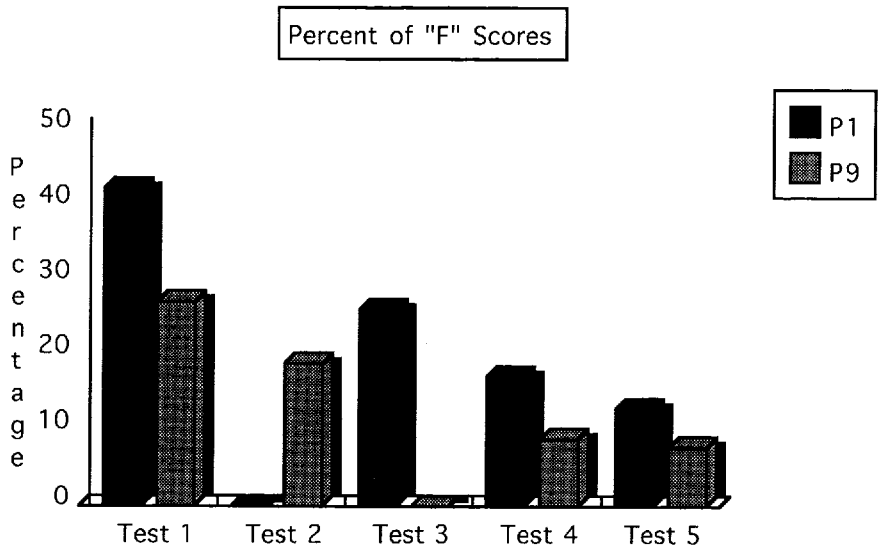



Percent of "A" Scores
Percentage
70
60
50
40
30
20
10
0
Test 1
Test 2
Test 3
Test 4
Test 5
P1
P9


Percent of "B" Scores
Percentage
40
30
20
10
0
Test 1
Test 2
Test 3
Test 4
Test 5
P1
P9


Percent of "C" Scores
Percentage
70
60
50
40
30
20
10
0
Test 1
Test 2
Test 3
Test 4
Test 5
P1
P9


Percent of "D" Scores
Percentage
55
50
45
40
35
30
25
20
15
10
5
0
Test 1
Test 2
Test 3
Test 4
Test 5
P1
P9


Percent of "F" Scores
P1
P9
Percentage
50
40
30
20
10
0
Test 1
Test 2
Test 3
Test 4
Test 5

CHAPTER 6

Conclusion

An analysis of the collected data shows a very limited increase in the level of success (based on the number of students obtaining an A grade) achieved in the experimental group as compared to the grades of the students in the control group. The data does not support the premise that altering teaching style to better match the learning styles of the students will produce a significant increase in the number of students achieving an A grade.

Although the students grades were not vastly different between the two groups, student attitude towards class and science as a whole was greatly enhanced. A substantial number of students expressed a marked increase in class enjoyment and all students participated in class to a greater extent. The students in period 1 (the experimental group) even started to tease students in period 9 (the control group) that I must "like them better" because I do "fun things" with them in class. Students in the control class frequently questioned why they couldn't have "fun" like the other class. This indicated that the students were discussing the differences in their classes and the experimental group clearly expressed their enjoyment of class while the control class felt

"cheated". The workload, homework, quizzes and tests were identical with the classes but there was a definite increase of class enjoyment and participation with the experimental group. The observed behaviors noted in the experimental group seems to have stemmed from teaching to the students comfort zone.

As educators we should strive to increase our students appetite for learning and desire to learn not just the bottom line; the test. Therefor, the less than supporting test and quiz grade data show only a small part of the learning experience. The idea of teaching in innovative and varying styles will still significantly enhance the science classroom experience and may eventually improve students grades.

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INDEX OF LEARNING STYLES

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DIRECTIONS

Circle "a" or "b" to indicate your answer to every question. Please choose only one answer for each question.

If both "a" and "b" seem to apply to you, choose the one that applies more frequently.

1.I understand something better after I

(a) try it out.

(b) think it through.

2.I would rather be considered

(a) realistic.

(b) innovative.

3. When I think about what I did yesterday, I am most likely to get

(a) a picture.

(b) words.

4. I tend to

(a) understand details of a subject but may be fuzzy about its overall structure.

(b) understand the overall structure but may be fuzzy about details.

5. When I am learning something new, it helps me to

(a) talk about it.

(b) think about it.

6. If I were a teacher, I would rather teach a course

(a) that deals with facts and real life situations.

(b) that deals with ideas and theories.

7.I prefer to get new information in

(a) pictures, diagrams, graphs, or maps.

(b) written directions or verbal information.

8. Once I understand

(a) all the parts, I understand the whole thing.

(b) the whole thing, I see how the parts fit.

9. In a study group working on difficult material, I am more likely to

(a) jump in and contribute ideas.

(b) sit back and listen.

10.I find it easier

(a) to learn facts.

(b) to learn concepts.

11. In a book with lots of pictures and charts, I am likely to

(a) look over the pictures and charts carefully.

(b) focus on the written text.

12. When I solve math problems

(a) I usually work my way to the solutions one step at a time.

(b) I often just see the solutions but then have to struggle to figure out the steps to get to them.

13. In classes I have taken

(a) I have usually gotten to know many of the students.

(b) I have rarely gotten to know many of the students.

14. In reading nonfiction, I prefer

(a) something that teaches me new facts or tells me how to do something.

(b) something that gives me new ideas to think about.

15.I like teachers

(a) who put a lot of diagrams on the board.

(b) who spend a lot of time explaining.

16. When I'm analyzing a story or a novel

(a) I think of the incidents and try to put them together to figure out the themes.

(b) I just know what the themes are when I finish reading and then I have to go back and find the incidents that demonstrate

them.

17. When I start a homework problem, I am more likely to

(a) start working on the solution immediately.

(b) try to fully understand the problem first.

18.I prefer the idea of

(a) certainty.

(b) theory.

19.I remember best

(a) what I see.

(b) what I hear.

20. It is more important to me that an instructor

(a) lay out the material in clear sequential steps.

(b) give me an overall picture and relate the material to other subjects.

21.I prefer to study

(a) in a study group.

(b) alone.

22.I am more likely to be considered

(a) careful about the details of my work.

(b) creative about how to do my work.

23. When I get directions to a new place, I prefer

(a) a map.

(b) written instructions.

24.I learn

(a) at a fairly regular pace. If I study hard, I'll "get it."

(b) in fits and starts. I'll be totally confused and then suddenly it all "clicks."

25.I would rather first

(a) try things out.

(b) think about how I'm going to do it.

26. When I am reading for enjoyment, I like writers to

(a) clearly say what they mean.

(b) say things in creative, interesting ways.

27. When I see a diagram or sketch in class, I am most likely to remember

(a) the picture.

(b) what the instructor said about it.

28. When considering a body of information, I am more likely to

(a) focus on details and miss the big picture.

(b) try to understand the big picture before getting into the details.

29.I more easily remember

(a) something I have done.

(b) something I have thought a lot about.

30. When I have to perform a task, I prefer to

(a) master one way of doing it.

(b) come up with new ways of doing it.

31. When someone is showing me data, I prefer

(a) charts or graphs.

(b) text summarizing the results.

32. When writing a paper, I am more likely to

(a) work on (think about or write) the beginning of the paper and progress forward.

(b) work on (think about or write) different parts of the paper and then order them.

33. When I have to work on a group project, I first want to

(a) have "group brainstorming" where everyone contributes ideas.

(b) brainstorm individually and then come together as a group to compare ideas.

34.I consider it higher praise to call someone

(a) sensible.

(b) imaginative.

35. When I meet people at a party, I am more likely to remember

(a) what they looked like.

(b) what they said about themselves.

36. When I am learning a new subject, I prefer to

(a) stay focused on that subject, learning as much about it as I can.

(b) try to make connections between that subject and related subjects.

37.I am more likely to be considered

(a) outgoing.

(b) reserved.

38.I prefer courses that emphasize

(a) concrete material (facts, dat(a).

(b) abstract material (concepts, theories).

39. For entertainment, I would rather

(a) watch television.

(b) read a book.

40. Some teachers start their lectures with an outline of what they will cover. Such outlines are

(a) somewhat helpful to me.

(b) very helpful to me.

41. The idea of doing homework in groups, with one grade for the entire group,

(a) appeals to me.

(b) does not appeal to me.

42. When I am doing long calculations,

(a) I tend to repeat all my steps and check my work carefully.

(b) I find checking my work tiresome and have to force myself to do it.

43.I tend to picture places I have been

(a) easily and fairly accurately.

(b) with difficulty and without much detail.

44. When solving problems in a group, I would be more likely to

(a) think of the steps in the solution process.

(b) think of possible consequences or applications of the solution in a wide range of areas.

Scoring of Learning Style Inventory

1. Put "1"s in the appropriate spaces in the table below (e.g. if the student answered "a" to Question 3, they would put a "1" in Column "a" by Question 3).

2. Total the columns and write the totals in the indicated spaces.

3. For each of the four scales, subtract the smaller total from the larger one. Write the difference (1 to 11) and the letter (a or b) with the larger total.

For example, if under "ACT/REF" you had 4 "a" and 7 "b" responses, you would write "3b" on the bottom line under that heading (3 = 7- 4, and the "b" total was the larger of the two.)

	ACT/REF			SEN/INT			VIS/VRB			SEQ/GLO	
Q	**a**	**b**	**Q**	**a**	**b**	**Q**	**a**	**b**	**Q**	**a**	**b**
1	__	__	2	__	__	3	__	__	4	__	__
5	__	__	6	__	__	7	__	__	8	__	__
9	__	__	10	__	__	11	__	__	12	__	__
13	__	__	14	__	__	15	__	__	16	__	__
17	__	__	18	__	__	19	__	__	20	__	__
21	__	__	22	__	__	23	__	__	24	__	__
25	__	__	26	__	__	27	__	__	28	__	__
29	__	__	30	__	__	31	__	__	32	__	__
33	__	__	34	__	__	35	__	__	36	__	__
37	__	__	38	__	__	39	__	__	40	__	__
41	__	__	42	__	__	43	__	__	44	__	__

ACT/REF		SEN/INT		VIS/VRB		SEQ/GLO	
a	b	a	b	a	b	a	b
—	—	—	—	—	—	—	—

(Larger - Smaller) + Letter of Larger (see below*)

____ ____ ____ ____

*Example: If you totaled 3 for a and 8 for b, you would enter 5b.

Quiz Ch 14

Name_____

Period _____

Date _____

1. A disease associated with concentrated mercury levels whose symptoms indicated bone and nerve damage, and in extreme cases, death was
   a. mercurial biomagnification
   b. mercurial bioaccumulation
   c. Minamata disease
   d. Eocide disease

2. Characteristics of a compound or element which lead to its bioaccumulation include its being
   a. readily absorbed by the body
   b. excreted slowly, if at all
   c. nonbiodegradable
   d. all of the above

3. Biomagnification refers to
   a. increase in concentration of a pollutant as it moves through the food chain
   b. certain traits becoming more pronounced through natural selection
   c. growth in size of individuals when given optimum nutrition
   d. increase in populations when environmental resistance is low

4. T/F A widely used pesticide in the US is DDT.

5. T/F It is thought that there is no correlation between bioaccumulation and resistance to disease in affected organisms.

6 T/F Small amounts of contaminants introduced repeatedly by many users are much more environmentally devastating than one large disaster.

7. T/F Biomagnification is the build-up of toxic organic compounds within the tissues of a single organism.

8. Mercury contamination named after a Japanese fishing village is _____ .

9. Concentration of toxins within an individual is referred to as

_____ .

10. Build-up of contamination through a food chain refers to

_____ .

Quiz Ch. 14 Name _____
Period _____
Date_____

Match the example with their EPA category.

1. Gasoline	A. corrosive
2. Acids	B. Toxic
3. Explosives	C. Ignitable
4. Pesticides	D. Reactive

6. Define Hazmat.

_____

_____

7. List 4 sources of chemicals entering the environment._____

_____

_____

_____

8. The 2 major classes of chemicals that are particularly significant environmental pollutants are

_____ and _____

9. Indicate the meaning of the following terms:

Carcinogenic _____

Mutagenic _____

Teratogenic _____

Quiz Name _____

Period _____

Date _____

pp. 403-409 Wild Species

Multiple Choice Circle the correct answer

1. A species of plant having nutritional as well as medicinal benefits for humanity would be referred to as having
a. individual value
b. intrinsic value
c. instrumental value
d. species value
e. ecological value

2. All plants, animals, and microbes which constitute ecosystems are referred to as the
a. biomes
b. biomass
c. biota
d. biosphere
e. bionics

3. Which of the following would NOT be included in a consideration of biota?
a. solar energy
b. propagated plant species
c. microbes
d. parasites
e. exotic animals

4. Natural species are of value for all of the following EXCEPT
a. commercial value
b. aesthetic value
c. causing air pollution
d. medical uses
e. intrinsic value

5. Values of natural biota would NOT include
a. aesthetic and recreational value
b. provision of mineral resources

c. provision of commercially valuable products
d. provision of natural services
e. providing a bank of genetic resources

6. In the United States, what percent of the pharmaceuticals used today contain ingredients originally derived from native plants?
a. 10 b. 25 c. 35 d. 55 e. 70

7. Which of the following illustrates aesthetic use of natural biota?
a. swimming
b. bird watching
c. sport fishing
d. collecting shells
e. all of the above

8. Destroying natural biota will seriously undercut our
a. ability to maintain vigor in agricultural species
b. potential for developing biological pest control
c. potential for developing new medicinal drugs
d. all of the above

True or False Write T or F after each statement
9. Some biological organisms have absolutely no intrinsic value whatsoever, and can be eliminated.

10. Philosophically, to be entirely consistent, animals rights individuals should be vegetarians.

11. The improved development of modern cultivated plants and animals is best done by continued breeding of cultivars for higher production.

12. Most improved traits in present day cultivated species come from related wild natural populations .

13. If natural biota of wild populations are lost, options for continued improvements in domesticated plants and animals will be greatly reduced.

14. The broadest public support in North America for preserving wild species and habitats can be traced to the commercial values placed on the species.

15. Modern agriculture today is now focusing its efforts on hundreds of potentially new wild plants.

16. Humans have explored the use of only about 7000 species of the hundreds of thousands of living plant species today.

Quiz Name _____
Period _____
Date _____

1. List the 3 land disposal methods commonly used by companies to dispose of liquid waste.

a_____

b_____

c_____

2. What two pieces of legislation led to the creation of these land disposal methods?

a_____

b_____

3-10 Read the following statements and determine what land disposal method it describes.

3. Least Expensive _____

4. water evaporates, wastes stay behind _____

5. Most effected by earthquakes _____

6. Uses very little ground surface. _____

7. Secure if capped properly _____

8. Most effected by severe rain, floods _____

9. Wastes can "back flow" _____

10. Loss of developmental land, uses large amounts of ground surface. _____

Quiz Name _____
Period _____
Date _____

Chapter 22: NUCLEAR POWER, COAL, AND SYNTHETIC FUEL

MULTIPLE CHOICE Choose the answer which makes the statement most correct.

1. The country committed to producing over 80% of its electricity from nuclear power is:
a. Canada
b. England
c. France
d. Japan
e. United States

2. The U.S. currently produces about_____ percent of its electricity by nuclear power,

a. 10%
b. 20%
c. 30%
d. 50%
e. 80%

3. The splitting of a large atom of one element into two smaller atoms of different elements is called

a. atom smashing
b. nuclear fission
c. nuclear fusion
d. atomic transformation
e. atom exchange

4. The combing of two small atoms to form a larger different atom is called

a. fission
b. fusion
c. conjugation
d. atomization
e. atom exchange

5. A nuclear chain reaction refers to

a. chains being affected by acid rain
b. a basic food chain
c. the splitting of one atom causing the splitting of another
d. the fissioning of one atom causing the fusion of others
e. the release of energy in a nuclear explosion

6. The amount of 235U in relation to 238U used in a nuclear power plant reactor is

a. 1%
b. 3%
c. 5%
d. 10%
e. 15%

7. Control rods control the nuclear reaction by absorbing

a. energy
b. neutrons
c. radioactive wastes
d. Uranium
e. heat

8. The moderator in U.S. nuclear power plants is

a. very pure water
b. heavy water
c. aluminum
d. 238 U

9. The uncontrolled heat of a nuclear reactor reaching such a high temperature as to cause the materials of the core to melt is called a/an:

a. "reactor blow"
b. Uranium melt
c. "RCS"-reactor collapse syndrome
d. India syndrome
e. meltdown

10. In a nuclear reactor of a power plant

a. the rate at which Uranium atoms split is controlled by inserting rods of neutron-absorbing material between rods of Uranium fuel
b. energy from the reactor is released directly as electricity

c. if the reaction gets out of hand, the reactor may explode like a nuclear bomb
d. water from a nearby river or lake is used to cool
the reactor to maintain proper temperature

11. Which of the following is/are part of a nuclear power plant of the type used in the U.S.?

a. Uranium fuels rods and control rods
b. a pressure vessels
c. a heat exchanger
d. a turbogenerator
e. all of the above

TRUE/FALSE Determine the Following are True or False
12. One advantage of fusion over nuclear fission is the absence of spent fuel wastes.

13. In nuclear fission the mass of products obtained is less than the mass of the original material.

14. A chain reaction does occur in nature at times because U-235 atoms get too close together.

15. The nuclear reactor for a power plant is not able to explode like an atomic bomb.

COMPLETION Place the correct answer(s) on the blanks provided that make the given statement true.

16. The country in the world most committed to producing most of its electricity by nuclear programs is _____.

17. In the process known as _____ a large atom of one element is split to produce two smaller atoms of different elements while when two atoms combine to form a larger atom....

18. of a different element the process is termed _____ .

19. A different form of the same chemical element is called an_____ .

20. Material called a _____ slows down the fission neutrons in the reactor so that they travel at the proper speed to trigger another fission reaction.

Quiz Name _____
Period _____
Date _____

Wild Species pp. 415-420

Multiple choice

1. A species which is likely to become extinct in the near future unless efforts are made to save it is referred to as
a. endangered b. threatened c. decimated d. extinguishing

2. The desire to preserve wild species in the United State is coming from
a. a broad constituency of people
b. politicians
c. mostly ecologists
d. the religious right

3. The biological wealth of species is threatened by
a. overuse
b. introduction of foreign species
c. physical alteration of habitat
d. pollution
e. all of the above

4. A success story in the United States where hunting fees and regulations have helped save a species from extinction is with the
a. raccoon
b. wild turkey
c. mule deer
d. passenger pigeon
e. prairie dog

5. Which of the following statements is NOT TRUE? The snowy egret and other birds with exotic plumage were preserved through
a. federal legislation that diminished the market
b. changing social values regarding wearing feathers
c. hunters getting tired of hunting them
d. setting up preserves
e. all of the above

6. To save natural biota is necessary to
a. protect habitats from pollution
b. remove the economic incentives from exploitation
c. have regulations to restrict importing exotic species
d. protect habitats from alteration
e. all of the above

7. The situation regarding U.S. game animals generally illustrates
a. regulated hunting
b. regulated marketing
c. minimal economic incentive for poaching or black marketing
d. humans way of maintaining game species
e. all of the above

8. The biggest factor undercutting conservation of wildlife in the U.S. today is
a. uncontrolled hunting
b. habitat destruction
c. pollution
d. the tragedy of the commons
e. poaching

9. A major problem in preserving prominent endangered species such as the black rhino is
a. lack of a law providing protection
b. lack of preserves
c. economic value and poaching
d. lack of any effort to enforce the law

10. A major problem in preserving countless less known endangered species is
a. lack of a law providing protection
b. gaining official recognition of the species as endangered
c. economic value and poaching
d. lack of any effort to enforce the law
e. lack of knowledge to enforce the law

True or False

11. Hunting fees and restrictions have been successful in preserving various game species.

12. The number of animals killed on roadways now exceeds the number killed by hunters.

13. The United States Endangered Species Act of 1973 hasn't helped preserve a single species and therefore should be abolished.

14. A major shortcoming of the Endangered Species Act is that protection of a species is not provided until a species is officially listed as endangered or threatened.

15. Buying an item made from material from an endangered species contributes toward its extinction.

Quiz Name _____
Period _____
Date _____

Loss of Biodiversity

1.) Explain how the Alaskan Pipeline is an example of habitat alteration. Specify the type of alteration.

2.) List and explain the 2 main reasons we should not introduce exotic species to an area.

3.) Over geological time, the net balance between and has favored an accumulation of species.

4.) List and explain several factors that the increase in human population may affect.

5.) How can clear cut logging be an example of both overuse and simplification?

Quiz
Period
Date

Name _____

Wild Species
Crossword Puzzle

ACROSS Clues

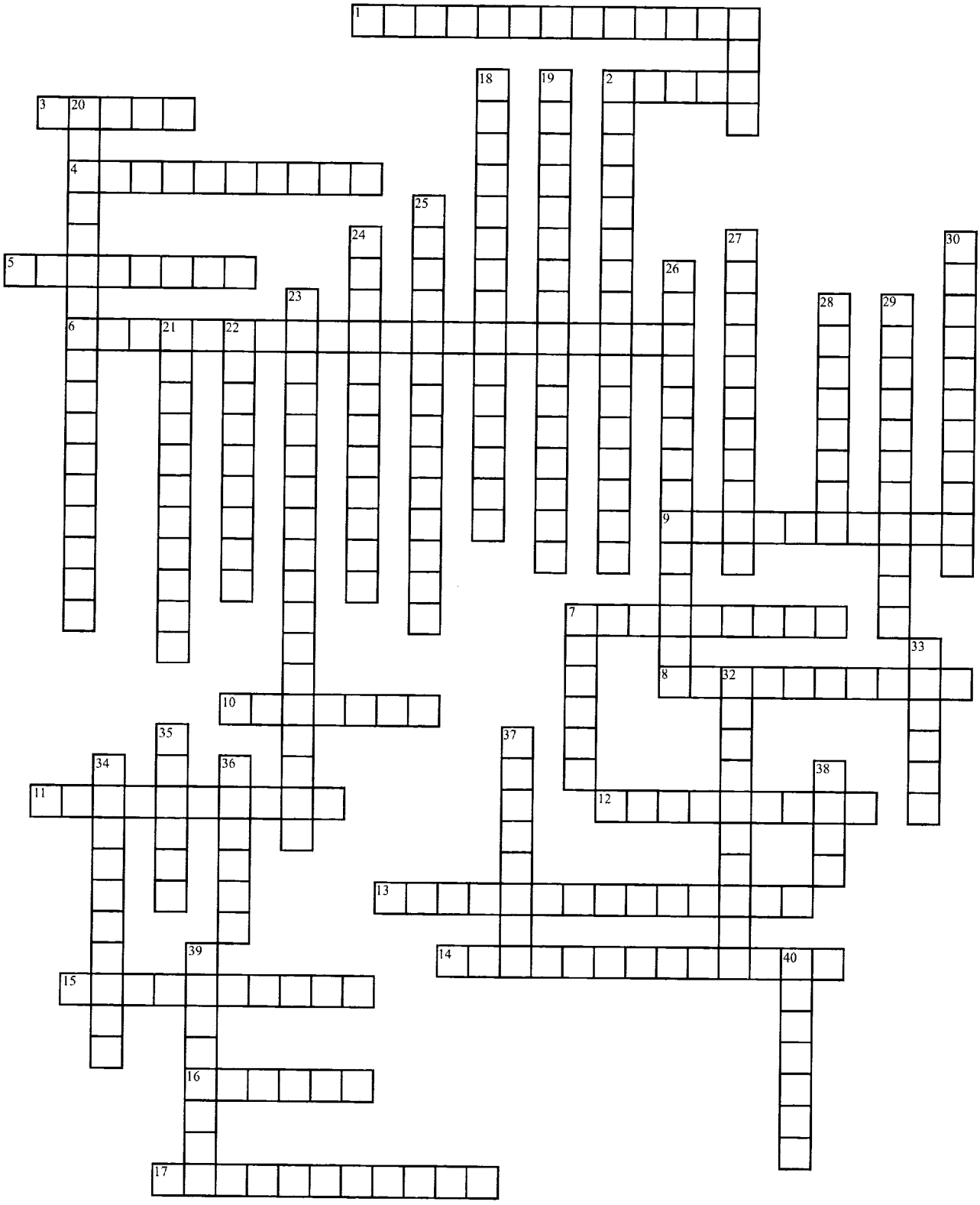
1 this greenhouse effect may be the greatest catastrophe to hit natural biota in 60 million years
2 natural species of living things
3 strength that enables living things to survive
4 the creation of new species
5 a destructive exotic, *Felis domesticus*
6 this act of congress (1973), was a major step to protect species from extinction
7 this "side effect" of human activity is a form of habitat destruction
8 the disappearance of species
9 when a natural area is converted, for example, to a shopping mall
10 this owl has become a focal point in the battle to save old growth forests of the Pacific Northwest
11 when tourists visit a place in order to observe unique ecological sites
12 this snake came to Guam as a stowaway on a cargo ship
13 when human interference simplifies a habitat
14 when the certain minimum area required to support a natural population is reduced
15 a bean species that produces abundantly under dry conditions
16 this bird is making a comeback in the U.S. due to hunting restrictions
17 this aquatic exotic species has invaded the Great Lakes

DOWN Clues

2 a form of wealth, it sustains human life and economic activity
7 the piping plover is a small shorebird well adapted to life on ocean beaches just beyond the high tide line
18 centered around man
19 selection of species best adapted for survival and reproduction
20 a value that benefits some other entity

21 pioneer in the field of conservation and environmental ethics
22 when Aldo Leopold saw this in the wolfs eyes, he changed his attitude
23 this ecosystem has more species than any other on Earth
24 diversity of living things in the natural world
25 a plant of Madagascar that revolutionized the treatment of leukemia and Hodgkin's disease
26 value for its own sake
27 bank of genes from natural biota
28 highly selected strain of the original species with a minimum of genetic variation
29 some say that only this species has intrinsic value
30 a chemical extracted from the rosy periwinkle that is now used to treat childhood leukemia
31 on this island there is no natural predator for the browntree snake
32 this person finds, describes, and classifies new species
33 efforts to save the California _____ has met with some success
34 continuing human growth will cause loss of more wild species
35 an species is one introduced into an area from somewhere else
36 these bees play a vital role in tropical forests by pollinating trees
37 this aquatic weed is a destructive exotic in Florida
38 more white-tailed _____ are killed on roadways than by hunters
39 a species is one whose role is absolutely vital for the survival of many other species in an ecosystem
40 this is driven by economic greed, ignorance, and insensitivity

CROSSWORD PUZZLE - WILD SPECIES



Quiz Name _____
Period _____
Date _____

Nuclear Power

Fill In the Blank with the correct answer.

1. Currently _____ countries rely on some form of nuclear power.
2. Why did the U.S. try to develop nuclear power after WWII? _____

_____

_____

3. Who sets and maintains safety standards for nuclear power plants ? _____

_____

4. When did nuclear power reach it's peak in the US? _____
5. What is the number one determining factor in reviving the dream of nuclear power?

_____

6. What isotope of Uranium is used in nuclear power plants? _____
7. Compare and contrast fusion and fission. _____

_____

_____

_____

8. Which process is employed in nuclear power plants? _____
9. What are radioactive emissions? _____

_____

10. What 2 countries are committed to seeing nuclear power succeed? _____

_____

Quiz Name _____
Period _____
Date _____

Select **5** short answer questions from the list below. Answer in complete sentences. If you cannot fit all of your answers on this page you may continue on loose leaf and staple it to this quiz sheet.

1. How does the enrichment of Uranium prevent LDC's from pursuing commercial nuclear power?

2. Compare the current outlook for nuclear power in the U.S. with the outlook for the 1960's and 1970's.

3. What are some features of nuclear power that make it such an attractive alternative to fossil fuel?

4. Explain a sustaining chain reaction and a self-amplifying chain reaction.

5. What events lead to the scramble to put nuclear power in place in developed nations?

6. What is a moderator, how does it work, and what type of moderator is employed in U.S. nuclear power plants?

7. Compare and contrast the isotopes of Uranium.

8. How does a nuclear reactor prevent amplification of uranium?

9. What are fuel elements and what is their function?

10. What are control rods and where are they located in relation to the other components in a reactor core?

Quiz Name_____
Period _____
Date _____

Ethics

Tug of water

page 256

After reading, summarize the main points of the article and answer the following questions. You may use the bottom and back of this paper to answer.

1. What are the values involved in this dispute?

2. Should the government be allowed to allocate the water? If yes, how? If not, who and how?

3. What should be done to promote conservation? Is this feasible? Would it likely be accepted by all parties involved? Explain.

4. Can unlimited growth be supported even with conservation? Explain your answer.

5. Is the government obligated to provide water as more and more people move to water short areas? If yes, how? If not, how do we limit growth?

Test 1

PLEASE DO NOT WRITE ON THE TEST

MULTIPLE CHOICE Choose the answer which makes the statement most correct.

1. A stream channel subjected to frequent flooding will become
   a. broader
   b. shallower
   c. deeper
   d. deeper and broader
   e. shallower and broader

2. As water evaporates, minerals in solution
   a. go into the air along with water molecules
   b. remain behind
   c. are degraded to nothing
   d. none of the above

3. Compared to a natural forest or grassland ecosystem, a suburban development will have
   a. more infiltration and less runoff
   b. less infiltration and more runoff
   c. less infiltration and less runoff
   d. more infiltration and more runoff
   e. the same infiltration and more runoff

4. As water soaks through the soil, it may dissolve and carry along various chemicals. This process is referred to as
   a. evapotranspiration
   b. precipitation
   c. leaching
   d. percolation
   e. infiltration

5. The greatest precipitation occurs
   a. on the windward (upwind) side of mountain ranges
   b. the leeward (downwind) side of mountain range
   c. over grasslands
   d. over river valleys
   e. over plains

6. An aquifer in which the water is under pressure is called a/an
   a. artesian aquifer
   b. seep
   c. vent
   d. geyser
   e. spring

7. In the evaporation of water
   a. there is an increase in kinetic energy of the water molecules
   b. there is breaking of the hydrogen bonds between water molecules
   c. water molecules separate from each other
   d. water molecules break up into separate oxygen and hydrogen atoms
   e. all of the above are true except "d"

8. The force which tends to hold water molecules together with each other is
   a. hydrogen bonding
   b. covalent bonding
   c. kinetic energy
   d. ionic bonding
   e. potential energy

9. A falling water table may be caused by
   a. decreasing infiltration
   b. excessive withdrawal of groundwater
   c. reduced seep and spring flow
   d. increasing runoff
   e. all of the above

10. Which of the following is NOT likely to occur as a result of withdrawing groundwater faster than its recharge rate?
   a. land subsidence
   b. development of sink holes
   c. decrease in production of irrigated crops
   d. increased pollution of groundwater
   e. saltwater intrusion along coastal regions

11. Most of the water used in homes and industry is used
   a. for drinking by employees
   b. to wash, clean, rinse, and flush away undesired materials
   c. in manufacturing processes
   d. for flushing employee toilets
   e. none of the above

12. If relative humidity goes over 100 percent
   a. water will turn to ice
   b. water will boil.
   c. water vapor will condense
   d. the system will explode
   e. more water will evaporate

13. Water that soaks into the ground and continues to move downward is referred to as

a. capillary water b. gravitational water c. infiltration
d percolation. e. surface runoff water

14. The most ecological and economically sound strategy for assuring that water supplies meet demand in the future is to

a. promote water conservation and reuse
b. start constructing vast new water diversion projects
c. increase deep drilling for additional groundwater supplies
d. promote climate control projects to increase rainfall
e. add more irrigated land to production

15. Deserts generally occur

a. on the windward side of mountains
b. on the lower elevations of mountains
c. on the leeward side of mountains
d. at regions farthest from the sea
e. none of the above

16. When water is heated over a fire or on a modern electric range

a. hydrogen bonding increases
b. potential energy increases
c. kinetic energy increases
d. hydrogen bonding energy increases
e. covalent bonding energy increases

17. When an agricultural or forested area gives way to suburban development, the streams in the area

a. will not be affected
b. will carry more water when it rains
c. carry less water when it doesn't rain
d. carry more water when it rains and less when it doesn't
e. carry less water when it rains and more when it doesn't

18. Precipitation is less likely to occur under

a. rising air currents b. descending air currents c. northward moving currents
d. southward moving currents e. unpredictable situations

19. All the land area from which water drains into a particular stream system is known as the stream's

a. channel b. system flow c. watershed d. stream path e. water course

20. A rain shadow refers to the
    a. region of low precipitation down-wind of mountain ranges
    b. region of high precipitation on the windward (up-wind) side of mountain ranges
    c. relative darkness of rainy days
    d. shadows cast by clouds
    e. region of low precipitation in the windward (up-wind) side of mountain regions

21. Many freshwater wells in coastal areas now yield salty water. The main cause of this problem is
    a. rising sea level
    b. excessive use of road salt
    c. excessive removal of fresh water is permitting salt water to move backwards into aquifers
    d. improper sewage treatment
    e. not known

22. In the U.S. water supplies are being expanded to meet growing demand mainly by
    a. treating sea waters
    b. damming more rivers
    c. drilling for groundwater
    d. recycling waste water
    e. producing synthetic water

23. The most water in the United States is used up in
    a. industry b. agriculture c. homes
    d. electric power generation e. commercial establishments

24. As polluted water evaporates and recondenses, the recondensed water
    a. is highly purified
    b. becomes more polluted
    c. has the same degree of pollution
    d. is changed in unpredictable ways
    e. none of the above

25. A body of water which has no outlet other than evaporation is bound to be
    a. cold b. fresh c. acidic d. warm e. salty

26. Considering the U.S. as a whole, the most water is used
    a. in homes
    b. in commercial establishments
    c. in manufacturing industries
    d. for irrigation
    e. none of the above

27. Water vapor is observed in the air when droplets condense as
    a. precipitation
    b. snow and sleet
    c. clouds and fog
    d. transpiration
    e. evapotranspiration

28. What is the maximum percentage of the average flow of a river that may be withdrawn without unduly risking water shortages or upsetting ecosystems?
    a. 10 b. 30 c. 50 d. 70 e. 100

29. Mono Lake is drying up because of
    a. earthquakes
    b. pollution
    c. diversion of rivers and streams which used to feed the lake
    d. withdrawing water from the lake itself
    e. all of the above

30. The state of water is determined by what two interacting factors?
    a. hydrogen bonding and covalent bonding
    b. kinetic energy and potential energy
    c. hydrogen bonding and kinetic energy
    d. covalent bonding and kinetic energy
    e. covalent bonding and potential energy

II. MATCHING (Fill in the blank) Match the correct word(s)from the word bank below to the statements 31-45. Not all answers may be used

31. Water vapor as droplets
32. Water soaking into the ground
33. Leeward side of mountains
34. Withdraws water from the Earth
35. Porous layers through which water moves in the Earth
36. The degree to which water is pure
37. Most dramatic example of water mismanagement
38. Force holding water molecules together

39. Measurement of water vapor in the air
40. Gradual settling of land
41. Landscaping with drought-resistant plants
42. Added to kill bacteria in drinking water
43. Water with one or more unwanted materials
44. Where freshwater mixes with sea water
45. Water that contains minerals

a. infiltration
b. capillary water
c. hydrogen bond
d. rain shadow
e. aquifer
f. condensation
g. chlorine
h. well
i. relative humidity
j. subsidence
k. water quantity
l. gravitational water
m. estuaries
n. hard water
o. ground water
p. water quality
q. polluted water
r. mineral water
s. Aral Sea
t. sinkholes
u. xeroscaping

III. TRUE AND FALSE

46. When land is deforested, rainfall loosens the soil, increasing the infiltration of the water.

47. In the Third World, water resources remain to a large extent undeveloped.

48. There is hardly a molecule of water we drink that has not been through organisms numerous times.

49. Neither developing more water resources nor conservation is an ultimate solution when faced with a rapidly growing population.

50. Agricultural irrigation in the U.S. is the largest consumptive user of water.

51. Untreated surface water is often contaminated with disease causing organisms.

52. Groundwater is generally safe for drinking.

53. River water that passes through many city municipal water treatment systems contains less polluted material than when it began flowing down the river.

54. The demand for water from the Colorado River has not yet reached the amount available.

55. A stream draining a forested area floods periodically because the packed leaf litter forces the water off the land.

56. Saturated layers of water in the Earth are easy to locate and follow.

57. In most situations, minerals that leach into the underground water system are not harmful.

58. An indication that a water table has dropped is when a spring stops flowing in the summer.

59. About 70 percent of the Earth's surface is covered by oceans and seas.

60. Freshwater resources are evenly distributed over the earth's surface.

Test

POLLUTION FROM HAZARDOUS CHEMICALS
PLEASE DO NOT WRITE ON THIS TEST

I. MULTIPLE CHOICE Choose the answer which makes the statement most correct.

1. Toxic materials are those substances which may
   a. explode when mixed with water
   b. catch fire and readily burn
   c. be injurious if inhaled or eaten
   d. contaminate soil and water
   e. be used as chemicals

2. Hazardous materials are ones that may be
   a. ignitable
   b. corrosive
   c. reactive
   d. toxic
   e. all of the above

3. The two main categories of toxic chemicals are
   a. heavy metals and synthetic organics
   b. particulates and ozone
   c. hydrocarbons and heavy metals
   d. lead and mercury
   e. carbon dioxide and ozone

4. Chlorinated hydrocarbons are a major subcategory of
   a. heavy metals
   b. particulates
   c. air pollutants
   d. synthetic organic compounds
   e. the ozone layer

5. During the life span of a chemical
   a. it is only hazardous or toxic in its pure state
   b. it is only hazardous or toxic when it is no longer useful for the intended purpose
   c. it is only hazardous or toxic if it bioaccumulates
   d. it may be hazardous or toxic at any stage during its lifetime either in its pure state or combined with other substances
   e. it is always hazardous or toxic

6. Halogenated hydrocarbons are
   a. organic compounds in which iodine, bromine, chlorine, and/or fluorine atoms have been added in place of one or more hydrogen atoms
   b. widely used as pesticides

c. relatively new compounds developed by chemists mostly in the past 50 years
d. compounds developed to be resistant to biodegradation
e. all of the above

7. Which of the following statements is NOT TRUE? Synthetic organic chemicals
a. are based on a structure of carbon atoms
b. can be rendered harmless through dilution
c. are man-made
d. have similarities to natural organic compounds
e. may interfere with various chemical reactions of metabolism

8. Which of the following statements is NOT TRUE? Synthetic organic compounds which are toxic
a. have a structure based on carbon atoms as do natural organic compounds
b. are readily absorbed into the body
c. are readily broken down by the body
d. are not readily excreted by the body
e. are human made

9. A disease associated with concentrated mercury levels whose symptoms indicated bone and nerve damage, and in extreme cases, death was

a. Mercurial biomagnification
b. Mercurial bioaccumulation
c. Minimata disease
d. Eocide disease
e. Moribund disease

10. Characteristics of a compound or element which lead to its bioaccumulation include its being
a. readily absorbed into the body
b. excreted very slowly, if at all
c. nonbiodegradable
d. soluble in water or oils
e. all of the above

11. Biomagnification refers to
a. the increase in concentration of a pollutant as it moves up the food chain
b. certain traits becoming more pronounced through natural or artificial selection
c. growth in size of individuals when given optimum nutrition
d. increase in populations when environmental resistance is low
e. two or more factors interacting together causing a much greater effect than each factor would acting alone

12. Since the passage of the Clean Water Act
    a. the Water Quality of many streams and rivers has improved
    b. the quality of groundwater has improved
    c. the quality of both streams and rivers and groundwater has improved
    d. the quality af water in lakes and oceans has improved
    e. none of the above

13. Prior to the 1970h industries generally
    a. disposed of wastes in secured facilities
    b. incinerated wastes
    c. discharged wastes into surface waterways, through smokestacks, or directly into the air
    d. recycled waste
    e. did not produce waste

14. Hazardous wastes have become an increasing threat since the 1950's because
    a. industries have become increasingly careless regarding their disposal
    b. such materials are produced and used in much larger quantities
    c. users have become increasingly careless in using these materials
    d. regulations regarding use and disposal have become more lax
    e. money to fund clean-up of contaminated sites has run out

15. In the late 1960's the most significant factor that contributed to curtailment of indiscriminate discharges and disposal of hazardous wastes was
    a. the almost single handed efforts of President Nixon
    b. the promotion of controls by the Environmental Protection Agency
    c. the public outrage by worsening pollution
    d. the laws promoted by a few congressmen
    e. none of the above

16. Which of the following DOES NOT regulate discharge/disposal of hazardous material into waterways or air?
    a. Comprehensive Environmental Response, Compensation, and Liability Act
    b. The Clean Water Act
    c. The Clean Air Act
    d. The Safe Water Drinking Act -
    e. RCA

17. Midnight dumping involves
    a. unscrupulous "fly-by-night operators
    b. dumping or leaving drums of hazardous wastes on vacant land or in abandoned buildings

c. dumping hazardous wastes in non-secure municipal land~ls under the cover of darkness
d. all of the above
e. none of the above

18. Which of the following statements is NOT TRUE?

a. Many municipal water supplies are tainted with chemicals known to be toxic.
b. There are many known sites where toxic chemicals are or may be leaking into groundwater.
c. Both private and municipal wells have been shut down because of unsafe levels of toxic chemicals
d. Many people have been injured by drinking unknowingly from contaminated water supplies
e. none of the above

19. The main intent of "Superfund" legislation is to
a. tax the chemical industry
b. provide money to clean up existing toxic wastes
c. tax the chemical industry to provide money to clean up toxic wastes
d. provide for the proper disposal of toxic wastes currently being produced
e. provide for advanced sewage treatment

20. When groundwater is contaminated from a leaking storage tank, remediation
a. is impossible
b. may be accomplished by injecting neutralizing chemicals
c. may be accomplished by walling it off
d. may be accomplished by pumping and treating the contaminated water
e. has only had limited success at cleaning up groundwater contamination, and will shortly be discontinued

21. A prioritized list of severely contaminated sites is the first step in the implementation of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. This list is the
a. Toxic Mobil Incinerator List
b. National Priorities List
c. Hazardous Priorities List
d. Toxic Wastes Priorities List
e. TSCA

22. Groups such as the Toxic Avengers, Watchdogs, and the Good Road Coalition are grass roots movements whose aims are to:

a. fight environmental racism
b. oppose the construction of commercial incinerators
c. oppose the construction of nuclear power plants
d. stir up trouble and obscure issues
e. inform the general public about products made with toxic materials

23. Which of the following statements is TRUE? Toxic wastes generated by households
a. have been shown to be insignificant
b. are significant and should be brought under the regulations of RCA
c. may be handled by occasional toxic waste pickups and public education
d. should be banned
e. should be monitored and controlled by the same laws that control industry

24. Which of the following statements is NOT TRUE? Attempts are made to minimize the injuries and deaths resulting from accidents occurring during the transportation of hazardous materials by
a. DOT regulations regarding the containers and packing of hazardous materials they are carrying
b. requiring vehicles to be labeled regarding the nature of hazardous materials they are carrying
c. having teams of firefighter trained in hazardous waste emergency response
d. evacuating people for, safe distances when an accident involving hazardous materials occurs
e. moving all hazardous wastes by rail because they have the best safety record with hazardous waste transport

25. In your home you may be exposed to hazardous materials through
a. fumes given off from hobby/art supplies
b. fumes given off from building materials
c. fumes given off from stoves or furnaces
d. seepage of radon gas from the earth
e. all of the above

MATCHING Match the correct word(s) BELOW with the phrases 26-35 by placing the correct letter on the blank provided. Not all answers may be used.

26. HAZMAT

27. Begins with production and ends with final discard

28. lead, mercury, and zinc

29. Build-up of contamination through a food chain

30. concentration of toxins within an individual

31. Mercury contamination named after a Japanese fishing village

32. A technique for disposing of large amounts of liquid wastes

33. The "battle cry" of hazardous wastes opponents

34. Return to uncontaminated condition

35. "burning issue"

A. heavy metals
B. hologenenated hydrocarbons
C. life span
D. Love Canal
E. evaporation
F. hazardous material
G. surface impoundment
H. remediation
I. bioaccumulation
J. Toxic Substance
K. Minamata disease
L. SARA, Title III
M. deep well
N. incineration
O. Biomagnification

TRUE AND FALSE

36. In the late 1960's the most significant factor that contributed to curtailment of indiscriminate discharges and disposal of hazardous wastes was public outrage at worsening pollution.

37. Relatively small but concentrated amounts of toxic chemical wastes are most likely to be disposed of in deep wells.

38. A deep, dry layer of porous rock is a necessary feature of deep well injection.

39. A severe thunderstorm could release all the chemical wastes into the environment from a surface impoundment.

40. If properly constructed and managed, all land based toxic chemical waste sites can be guaranteed as "safe forever" containment sites.

41. The main intent of "Superfund' legislation is to provide funds to clean up existing toxic waste sites.

42. The most practical, current alternative for disposal of wastes appears to be reclaim, recover, recycle.

43. Many of our individual health problems today are the result of believing that the pollution that was being produced was the "price of progress."

44. It is thought that there is no correlation between bioaccumulation and resistance to disease in affected organisms.

45. Small amounts of contaminants introduced repeatedly by many users are much more environmentally devastating than one larger disaster.

46. Biomagnification is the build-up of toxic organic compounds within the tissues of a single organism.

47. The three methods of disposing of toxic wastes in the early 1970's were deep-well injection, landfills, and incineration.

48. Even though there are mandated allowable levels of toxic chemicals that may be left in water as residual, no one knows with absolute certainty how much actually constitutes a harmful level.

49. The Safe Water Drinking Act of 1974 does not monitor or control wells owned by private citizens.

50. Technology now exists that makes it possible to purify contaminated water in aquifers.

51. The most comprehensive piece of legislation that provides for the unlawful and indiscriminate disposal of hazardous and toxic wastes is RCA.

52. Because of the high heat required to incinerate wastes, many mortuaries also provide incineration services.

53. Interstate commerce of hazardous and toxic materials is regulated by the Department of Transportation, which is a division of OSHA.

54. One of the problems with landfills is that the drums holding chemicals may corrode and precipitate a reaction between antagonistic chemicals resulting in explosion.

55. There are no laws to restrict the exportation and dumping of toxic substances in Third World and developing nations.

IV. COMPLETION

(Fill-in-the-blank) Place the connect answer(s) on the blank(s) provided that makes the statement true.

56. A law that is designed to prevent midnight dumping and indiscriminate land disposal of toxic wastes is _____ of 1976.

57. Readily available materials such as alcohols and lighter weight petroleum products are said to be _____ materials.

58. _____ are non-biodegradable, carbon-based manufactured products like plastics, paints and solvents, and pesticides.

59. The progress of returning water or soil to a usable state using microorganisms and excess oxygen is referred to as _____ .

60. _____ are synthetic organic compounds in which one or more hydrogen atoms that would normally be bonded to a carbon atom are replaced by chlorine, fluorine, bromine, or iodine atoms.

Test
Wild Species

DO NOT WRITE ON THE TEST.
Record your answers on the answer sheet provided. Thank you.

I MULTIPLE CHOICE statement most correct,

Choose the answer which makes the

1. A species of plant having nutritional as well as medicinal benefits for humanity would be referred to as having
   a. individual value b. instrumental value
   c. intrinsic value d. ecological value

2. All plants, animals, and microbes which constitute ecosystems are referred to as the
   a. biomes b. biomass c. biosphere d. biota

3. Which of the following would NOT be included in a consideration of biota?
   a. plant species b. exotic species c. solar energy d. parasites

4. Natural species are of value for all of the following EXCEPT
   a. commercial value b. causing air pollution
   c. aesthetic value d. medical uses

5. Values of natural biota would NOT include
   a. provision of mineral resources b. aesthetic and recreational value
   c. provision of natural services d. providing a bank of genetic resources

6. Most of the extinctions of biota in the past 200 years occurred
   a. in the United States b. on oceanic islands
   c. in desert regions of the world d. in arctic and alpine regions

7. In the United States, what percent of the pharmaceuticals used today contain ingredients originally derived from native plants?
   a. 10 b. 25 c. 35 d. 55

8. The region of the world where more living species live than any other place is the
   a. deciduous forest b. tropical rain forest
   c. temperate rain forest d. grassland

9. The greatest loss of biodiversity is caused by

a. pollution b. habitat alteration
c. hunting d. competition with exotic species

10. One of the most recently introduced problem exotic species in North America aquatic systems is the

a. buena bueller b. lamprey eel
c. duckweed d. zebra mussel

11. A species which is likely to become extinct in the near future unless efforts are made to save it is referred to as

a. endangered b. threatened c. decimated d. extinguishing

12. Which of the following statements is NOT TRUE?

a. Humans have already caused the extinction of hundreds of species.
b. Many hundreds of species are recognized as endangered.
c. Thousands of species are threatened.
d. Exotic species have relatively little impact on native species.

13. If unchecked, the activity or event that will likely lead to the most extinctions in the near future is

a. hunting b. dredging and filling of wetlands
c. the burning and clearing of tropical forests for agriculture
d. damming of rivers and diversion of water

14. Which of the following statements is NOT TRUE?

a. Supplying the market for exotic house pLants is threatening many species of plants.
b. Supplying the market for exotic pets is threatening many species of wildlife.
c. Hunting within the limits of laws is threatening the species of game animals.
d. Supplying the market for exotic skins, horns, hooves, and trinkets is endangering many species of wildlife.

15. A recent introduction into the Great Lakes of North America from ship ballast water that will cost billions of dollars over the next decade to deal with is the

a. zebra mussel b. razor clam
c. hag fish d. pondweed

16. Experience shows that when a resource is made available to any and all to use as they see fit

a. no one bothers to use the resource b. it is rapidly exploited and destroyed

c. there is the maximum benefit to the most people
d. a maximum sustainable yield is maintained

17. The desire to preserve wild species in the United States is coming from
a. politicians
b. mostly ecologists
c. the educational community
d. a broad constituency of people

18. A success story in the United States where hunting fees and regulations have helped save a species from extinction is with the
a. prairie dog
b. raccoon
c. mule deer
d. wild turkey

19. Which of the following statements is NOT TRUE? The snowy egret and other birds with exotic plumage were preserved through
a. federal legislation that diminished the market
b. hunters getting tired of hunting them
c. changing social values regarding wearing feathers
d. setting up preserves

20. The biggest factor undercutting conservation of wildlife in the U.S. today is
a. habitat destruction
b. uncontrolled hunting
c. pollution
d. poaching

21. A major problem in preserving prominent endangered species such as the black rhino is
a. lack of a law providing protection
b. lack of preserves
c. lack of any effort to enforce the law
d. economic value and poaching

22. A major problem in preserving countless less well known endangered species is
a. lack of a law providing protection
b. economical value and poaching
c. lack of any effort to enforce the law
d. gaining official recognition of the species as endangered

23. Most of the endangered species can be saved from extinction
a. only by preserving and protecting the ecosystems in which they live
b. by breeding them in captivity
c. by giving them to people to keep as pets
d. by hybridizing them with other more vigorous species

24. Buying an item made from material from an endangered species
a. shows good taste
b. contributes toward its extinction

c. shows esteem for the species d. has no relevance to protecting the species

25. Which of the following statements is NOT TRUE? You can protect natural biota by
    a. buying and taking care of exotic animal pets and plants
    b. joining a conservation organization
    c. writing your Congress persons to support debt-for-nature swaps
    d. writing your Congress persons to support UNEP

II. MATCHING

Match the correct word(s) on the right with the left by placing the correct letter on your answer sheet.

26. Natural species of living things	A. genetic value
27. Value for its own sake	B. exotic species
28. Value that benefits some other entity	C. Endangered Sp. Act
29. A cultivated variety	D. instrumental value
30, The gene pool of all species	E. extinction
31. Tourists visiting unique ecological areas	F. biota
32. The creation of new species	G. keystone species
33. The disappearance of species	H. Lacey Act
34. Introduced into an area from elsewhere	I. intrinsic value
35. Species role vital for survival of other species	J. speciation
36. Forbids interstate sale in the U.S. of illegally killed wildlife	K. ecotourism
37. Helps protect species from extinction	L. cultivar

III. TRUE AND FALSE Write true or false in the blank provided on your answer sheet.

38. Some biological organisms have absolutely no intrinsic value whatsoever, and can be eliminated.

39. Most improved traits in present day cultivated species come from related wild natural populations.

40. If natural biota of wild populations are lost, options for continued improvements in domesticated plants and animals will be greatly reduced.

41. Modern agriculture today is now focusing its efforts on hundreds of potentially new wild plants

42. The extinction of a species is an irretrievable loss of valuable biotic potential.

43. Every species that dies out doubtlessly will take other species with it.

44. If all natural areas remaining in North America today can be saved we should be able to maintain present levels of biodiversity such as prairie species and our songbird populations.

45. Minimum areas are required to support a critical number of individuals in any natural population.

46. The simplification of habitats does not necessarily reduce biodiversity as ecologists once thought.

47. The key to holding down the loss in biodiversity lies in bringing human population growth to a halt.

48. A benefit of nature is that most biota can adapt rapidly to changes to their environment.

49. Hunting fees and restrictions have been successful in preserving various game species.

50. A major shortcoming of the Endangered Species Act is that protection of a species is not provided until a species is officially listed as endangered or threatened.

Test

The Aim of Environmental Science

Please do not write on the test

Part 1 **Multiple Choice** Choose the answer that makes the statement most correct.

1. The view that all natural resources are to be exploited for human benefit is called
   a. humanism
   b. cornucopianism
   c. environmentalism
   d. capitalism
   e. progressivism

2. Which of the following is not sustainable?
   a. landfilling wastes
   b. use of fossil fuels
   c. making CFC's which affect the ozone layer
   d. using nuclear power
   e. all of the above

3. Environmentalists
   a. promote sustainable alternatives
   b. are anti-exploitation
   c. are anti-modern society
   d. all of the above

4. The term that applies to whether or not a process can be continued indefinitely is
   a. continuation
   b. adaptability
   c. sustainability
   d. succession
   e. permanence

5. The view that natural resources are products of the environment and will be limited by overuse and need human protection for wise use
   a. ecology
   b. ecosystem regeneration
   c. environmentalism
   d. cornucopianism
   e. altruism

6. Evidence that current human interactions with the environment are not sustainable include
   a. the hole in the ozone
   b. water pollution
   c. depletion/extinction of wildlife
   d. greenhouse effect
   e. all of the above

7. How we, as individuals, deal with our natural world will ultimately depend on
   a. our value system and biases
   b. money
   c. politics
   d. our jobs
   e. other people

8. The concept of sustainable development is to
   a. meet the needs of the present without compromising the future
   b. continue as always and assume that things will work out
   c. curtail all further development
   d. go back to primitive living
   e. meet the needs for one year in the future

9. Pursuing a direction that is not sustainable is best defined as
   a. a necessary trade off
   b. living on borrowed time
   c. environmentalism
   d. the only way to ensure survival
   e. the only economical way

10. The change over to a sustainable society will
   a. be a major disaster economically
   b. mean no modern conveniences
   c. be a conscious operation by all people
   d. be a simple thing to do
   e. none of the above

11. The study of how plants and animals interact with each other and their environment is termed
   a. biology
   b. botany
   c. environmental science
   d. ecology
   e. etiology

12. Which of the following is a false statement about science?
   a. Science cannot test value judgments.
   b. Science can test one time events.
   c. All questions can be answered by science.
   d. all of the above are false.

Part 2 **Matching** Indicate if the following assumptions characterize the cornucopian **(c)** or the environmental **(e)** point of view.

13. Is the dominant world view.

14. Natural resources are limited.

15. Change the direction of human uses of natural resources.

16. Represents a sustainable philosophy.

17. All natural resources are to be exploited for the advantage of humans.

18. Is easy and convenient.

19. High environmental regard.

20. Low environmental regard.

Part 3 **True and False** Determine if the following statements are true or false.

21. Using water power is a sustainable energy source.

22. History has shown that humans as individuals cannot influence the course of events.

23. People who are pro-environment are always anti-development.

Part 4 **Fill in the blank** Place the correct answer(s) on the blank(s) to make the statement true.

24-27. The four reasons for scientific controversy are __.

28. The term that applies to whether or not a process can be continued indefinitely is __.

Part 5 **Short answer** Answer **two** of the following questions using complete sentences and be sure to include the rationale for your answer.

1. Why would changing from a cornucopian society to an environmental one not be simple and easy?

2. Select an environmental issue that is controversial, and analyze the basis for the controversy. Explain.

3. Give evidence showing how the balance between cornucopianism and environmentalism is changing throughout the world.

4. Are you a cornucopian or an environmentalist? Write a short essay describing your own world view and your justification for it.

Test

Nuclear Power

Do not write on the test. Thank you.

MULTIPLE CHOICE

1. The country committed to producing over 80% of its electricity from nuclear power is:
   a. canada
   b. England
   c. France
   d. Japan
   e. USA
2. The US currently produces about _____ % of it's electricity by nuclear power.
   a. 10
   b. 20
   c. 30
   d. 50
   e. 80
3. The US currently has about _____ nuclear power plants in operation.
   a. 110
   b. 60
   c. 250
   d. 500
   e. 1000
4. Nuclear fusion
   a. is the splitting of a large atom into two smaller atoms of different elements.
   b. is the melting together of two small atoms into one large atom
   c. is the same as the regular fission that some people do on vacation.
   d. none of the above
5. The splitting of a large atom of one element into 2 smaller atoms of a different elements is called
   a. atom smashing
   b. nuclear fission
   c. nuclear fusion
   d. atom exchange
6. The combining of 2 smaller atoms to form a large different atom is called
   a. atom conjugation
   b. fission
   c. fusion
   d. atom exchange
7. Which of the following is not true? The splitting of a Uranium atom:
   a. results on no loss of mass. b. results in the conversion of mass energy.
   c. results in emitting high energy neutrons. d. produces dangerous waste products. e. may trigger the splitting of additional uranium atoms.

8. The uranium atom that is currently used in power plants is
    a. U 235
    b. U 238
    c. U 239
    d. U 245
    e. U 250
9. A nuclear chain reaction refers to
    a. Chains being affected by acid rain
    b. A basic food chain.
    c. The splitting of one atom causing the splitting of another.
    d. the fission of one atom causing the fusion of another.
    e. The release of energy in a nuclear explosion.
10. The amount of U 235 in relation to U 238 used in a nuclear power plant reactor is:
    a. 1%
    b. 3%
    c. 5%
    d. 10%
    e. 15%
11. Control rods control the nuclear reaction by absorbing
    a. energy
    b. neutrons
    c. radioactive wastes
    d. uranium
    e. heat
12. One advantage of nuclear power over a coal power plant is that the fissioning of _____ of uranium is equivalent to burning 1000 tons of coal.
    a. 1 pound
    b. 10 pounds
    c. 100 pounds
    d. 1000 pounds
    e. 1 ton
13. The moderator in US nuclear power plants is
    a. very pure water
    b. graphite
    c. U 238
    d. heavy water
    e. aluminum
14. It is generally considered that a radioactive material will decay to a safe level in"
    a. 1000 years
    b. 10 years
    c. 2 half lives
    d. 10 half lives
    e. never

15. Using engineering and design features that make it virtually impossible for a nuclear reactor to overheat is called:

a. active safety
b. passive safety
c. design safety
d. reactor safety
e. meltdown proof

II. SHORT ANSWER Answer each question completely on your answer key.

16. Explain a sustaining chain reaction and a self-amplifying chain reaction, and diagram a self-amplifying chain reaction.

17. Compare and contrast the isotopes of Uranium.

18. What are some features of nuclear power that make it such an attractive alternative to fossil fuel?

19. What events lead to the scramble to put nuclear power in place in developed nations?

20. What is a moderator, how does it work, and what type of moderator is employed in U.S. nuclear power plants?

PERSONAL DATA

I am currently employed as a high school science teacher by the Buena Regional School District in Southern New Jersey. I have taught General Physical Science, Honors Physical Science, General Biology, College Preparatory Biology, Honors Biology, Advanced Biology, A.P. Biology and Environmental Biology during my fifteen year tenure at the high school. Currently I am teaching Environmental Biology,College Preparatory Biology, and Honors Biology. Our district has an outstanding staff development program that has been instrumental in training teachers to become better. I have participated in numerous workshops and teacher development seminars on teaching and learning styles.

I grew up in Northeastern Pennsylvania and attended Bishop O'Hara High School in Dunmore. My undergraduate degree, Secondary Education, Concentration Biology was earned at Kutztown State College (currently Kutztown University of Pennsylvania) in 1983. My graduate work, through Rowan University, has been ongoing since 1989 with several interruptions due to a chronically ill child. Along with my M.A. in Teaching I am concurrently earning a Supervisory Certificate in Ed. Administration. I am the mother of three young boys, ages 10, 7, and 3 and have been married for 14 years.