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SCIENCE TEACHERS' CONCEPTIONS OF THE NATURE OF SCIENCE:
DO THEY REALLY INFLUENCE TEACHING BEHAVIOR?

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Improving the scientific literacy of the public is the most compelling challenge facing science educators (National Science Teachers Association, 1982). Furthermore, an adequate conception of the nature of science is considered to be a distinguished attribute of the scientifically literate individual (Collette & Chiappetta, 1984; Klopfer & Cooley, 1963; NSTA, 1982; Showalter, 1974). The "nature of science" has been defined in numerous ways, but it most commonly refers to the values and assumptions inherent to scientific knowledge (e.g., tentativeness, parsimony, empirically based, amoral).

Researchers have long been dismayed by the apparent misconceptions held by secondary school students (Bady, 1979; Rubba, Horner & Smith, 1981) as well as those misconceptions possessed by science teachers (Carey & Stauss, 1968, 1970; Miller, 1963; Schmidt, 1967). Consequently, much time and effort have been invested in programs specifically designed to improve science teachers' conceptions of science with the anticipation that improved student conceptions would necessarily follow. Such programs (Billeh & Hassan, 1975; Welch & Walberg, 1968) clearly assumed that a teacher's classroom behavior is influenced by his/her conception of the nature of science and that a significant positive relationship exists between teachers' conceptions and changes in the conceptions of their students. The presumed relationship between teachers' conceptions and their classroom behavior is a rather intuitive notion and has been reiterated throughout the three decades of research concerned with the "nature of science" (Cotham & Smith, 1981; Hurd, 1969; Robinson, 1972). Since this belief has provided the framework for much empirical research and curriculum development, one is readily disconcerted by the realization that it has remained virtually untested.

The purpose of this research was to test the validity of the prevalent assumption that a teacher's conception of the nature of science influences his/her classroom behavior. It is believed that the results of this investigation will help to redirect the focus of future efforts to promote more adequate conceptions of the

nature of science in our secondary school students.

SUBJECTS

The subjects consisted of 18 senior high school biology teachers and one randomly selected tenth grade biology class of each teacher. Each class was heterogenous with respect to sex, race, and socioeconomic status. The mean class size was 22.7 students. All instruction followed the New York State Biology Regents Syllabus (State Education Department, 1982).

METHOD

A blend of quantitative and qualitative techniques best served the purpose of this study. The design used was largely derived from the approach developed for the Beginning Teacher Evaluation Study (Tikunoff, Berliner, & Rist, 1975). Space does not permit a complete description of the entire methodology, but the most salient points are presented here.

The "Nature of Scientific Knowledge Scale" (NSKS; Rubba, 1976) was administered to each of the 18 teachers at the beginning and end of the fall semester. The NSKS is purported to be an objective measure of a respondent's understanding of the nature of scientific knowledge.

The instrument contains 48 statements with a Likert scale format containing five choices. In addition to a total score, the NSKS yields scores on each of six additive subscales. The subscales are as follows: 1) amoral (scientific knowledge itself cannot be judged as good or bad); 2) creative (scientific knowledge is partially a product of human creative imagination); 3) developmental (scientific knowledge is tentative); 4) parsimonious (scientific knowledge attempts to achieve simplicity of explanation as opposed to complexity); 5) testable (scientific knowledge is capable of empirical test); and 6) unified (the specialized sciences contribute to an interrelated network of laws, theories, and concepts).

One of the two researchers conducted intensive qualitative classroom observations in each of the 18 classes between the NSKS pretest and posttest. The teachers and students were aware of the researcher's presence but the practice of having another individual sitting in on the class was not an uncommon occurrence. The researcher was unaware of the teachers' NSKS pretest performance while making observations. During each observation, an attempt was made to record all teacher and student verbalizations, chalkboard notes, handouts, assignments, teacher mannerisms, nonverbal cues, and classroom physical plan. Classroom observations were conducted throughout the fall semester and resulted in over 1600 pages of field notes (approximately 90 pages per teacher).

Systematic pairwise qualitative comparisons were made among the 18 sets of field notes. These comparisons were made without knowledge of the teachers' NSKS scores and resulted in the derivation of 44 classroom variables which appeared to discriminate among the behaviors of the 18 teachers under investigation. A complete listing of these variables and their operational definitions is provided in Appendix A. An in-depth discussion of the procedure used to qualitatively derive classroom variables may be found elsewhere (Lederman & Druger, 1985). However, the primary focus of this investigation was to ascertain

whether any of the derived classroom variables were related to the teachers' conceptions of the nature of science. In order to pursue this question, NSKS scores (i.e., the mean of the pre- and post-test) were used to rank order teacher with respect to their overall and subscale scores. (Note: There were no significant differences between the pre- and post-test for teachers. (Those teachers who exhibited the highest scores (i.e., a ranking in the top six) on at least four of the seven NSKS scales were categorized as "high" and those exhibiting the lowest scores (i.e., a ranking in the bottom six) were categorized as "low". This procedure resulted in four teachers designated as "high" and four designated as "low". Only these teachers were used in subsequent analysis. The teachers' specific NSKS scores and their categorization may be found in Tables 1 and 2.

TABLE 1
Classification of Teachers With Respect
to Average (Mean of Pre- and Posttest) NSKS Score

Overall Scale	Amoral Subscale	Creative Subscale	Developmental Subscale	Parsimonious Subscale	Testable Subscale	Unified Subscale
High						
224 (G)	40 (H)	38 (N)	38 (F)	36 (G)	40 (H)	40 (O)
220 (L)	40 (O)	38 (G)	38 (R)	36 (L)	39 (F)	40 (L)
215 (H)	39 (L)	36 (H)	36 (N)	32 (H)	39 (O)	39 (N)
205 (K)	38 (G)	35 (E)	36 (H)	32 (R)	39 (L)	39 (G)
204 (O)	38 (E)	34 (L)	36 (G)	31 (I)	39 (B)	38 (F)
202 (C)	38 (B)	33 (K)	36 (B)	30 (Q)	38 (G)	38 (K)
Medium						
200 (E)	35 (I)	32 (B)	34 (I)	29 (C)	36 (K)	36 (H)
200 (B)	35 (K)	32 (D)	34 (K)	28 (O)	36 (M)	35 (E)
200 (R)	35 (F)	32 (P)	33 (E)	26 (N)	35 (N)	35 (J)
198 (F)	34 (Q)	32 (O)	33 (J)	26 (K)	35 (E)	34 (R)
194 (I)	33 (P)	31 (Q)	33 (L)	25 (J)	35 (C)	33 (B)
190 (J)	33 (C)	31 (J)	32 (Q)	25 (A)	35 (R)	33 (C)
Low						
186 (N)	31 (M)	30 (I)	30 (D)	24 (D)	34 (J)	32 (Q)
183 (M)	31 (R)	30 (A)	30 (P)	24 (B)	33 (I)	32 (A)
177 (P)	30 (N)	29 (C)	30 (A)	23 (H)	32 (D)	31 (H)
173 (D)	30 (A)	29 (M)	28 (C)	23 (F)	32 (Q)	30 (I)
172 (A)	26 (D)	27 (R)	27 (M)	21 (E)	32 (P)	30 (P)
165 (Q)	24 (J)	22 (F)	25 (O)	20 (P)	31 (A)	29 (D)

NOTE: The letters within the parentheses are the identification codes used to maintain anonymity of each teacher.

TABLE 2

Summary of Teacher Classification With Respect to NSKS Scores

Teacher	Overall Scale	Amoral Subscale	Creative Subscale	Developmental Subscale	Parsimonious Subscale	Testable Subscale	Unified Subscale
(A)	L	L	L	L		L	L
(B)		H		H	L	H	
(C)	H		L	L			
(D)	L	L		L	L	L	L
(E)		H	H		L		
(F)			L	H	L	H	H
(G)	H	H	H	H	H	H	H
(H)	H	H	H	H	H	H	H
(I)			L		H	L	L
(J)	L					L	
(K)	H		H				H
(L)	H	H	H		H	H	H
(M)	L	L	L	L	L		
(N)	L	L	H	H			H
(O)	H	H		L		H	H
(P)	L			L	L	L	L
(Q)		L			H	L	L
(R)		L	L	H	H		

The second researcher, who was unaware of the aforementioned classification scheme, systematically compared the field notes of each "high" teacher with each "low" teacher for each of the qualitatively derived classroom variables. For each variable, the researcher was asked to describe which teacher exhibited "more" or "less" of that particular variable. The researcher who originally derived the classroom variables also performed these same comparisons. An agreement level exceeding 96% was exhibited for the 16 teacher comparisons. The data generated by the comparison of field notes were perceived as a series of binomial variables and their statistical significance was tested accordingly. In summary, those variables which were found to statistically differentiate between "high" and "low" teachers were considered to be related to a teacher's conception of the nature of science.

RESULTS AND CONCLUSIONS

The ability of each classroom variable to statistically discriminate between "high" and "low" teachers was assessed using a non-directional binomial test ($\alpha = .05$). The results of this statistical analysis are presented in Table 3.

TABLE 3
Results of Paired Comparisons

Classroom Variable	"High" Teacher Exhibiting More	"Low" Teacher Exhibiting More	Probability (p)
<u>Teacher's General Instructional Approach</u>			
1. Anecdotal	8	8	> .9999
2. Dynamic	10	6	.4580
3. Emphasis on rote memory/recall	7	9	.8036
4. Extended lecturing	5	11	.2100
5. Frequent questioning	9	7	.8036
6. Fragmented	8	8	> .9999
7. Higher cognitive level questions	10	6	.4580
8. Instructional digression	11	5	.2100
9. Pacing	9	7	.8036
10. Periodic review	9	7	.8036
11. Predictable	5	11	.2100
12. Problem solving	7	9	.8036
13. Receptive to unsolicited questions	9	7	.8036
14. Rushing	12	4	.0766
15. Seat work	7	9	.8036
16. Sequential probing	7	9	.8036
17. Supportive	9	7	.8036
18. Use of humor	11	5	.2100
19. Variety of instructional media	11	5	.2100
<u>Teacher's Content-Specific Characteristics</u>			
20. Amoral	5	11	.2100
21. Anthropomorphic language	10	6	.4580
22. Arbitrary constructs	8	8	> .9999
23. Creativity	6	10	.4580
24. Developmental	7	9	.8036
25. Fallibility	6	10	.4580
26. Language accuracy	12	4	.0766
27. Misinformation	7	9	.8036
28. Moral & ethical implications	8	8	> .9999
29. Parsimony	7	9	.8036
30. Quantity of material	12	4	.0766
31. Relevancy	10	6	.4580
32. Superficiality	7	9	.8036
33. Testable	7	9	.8036
34. Unified	8	8	> .9999
<u>Teacher's Non-Instructional Characteristics/Attitude</u>			
35. Demeanor	8	8	> .9999
36. Impersonal	8	8	> .9999
37. Non-instructional digression	11	5	.2100
<u>Student Characteristics</u>			
38. Active engagement	12	4	.0766
39. Attentive	9	7	.8036
40. Unsolicited questioning	11	5	.2100
<u>Classroom Atmosphere</u>			
41. Discipline	7	9	.8036
42. Down time	3	13	.0210
43. Low anxiety	6	10	.4580
44. Rapport	7	9	.8036

Research concerned with an understanding of the "nature of science" as an outcome variable has consistently assumed that a teacher's classroom behavior is directly influenced by his/her own conception of the nature of science (Billeh & Hassan, 1975; Cotham & Smith, 1981). Consequently, much research has focused on the improvement of teachers' conceptions as a mechanism for bringing about improvement of students' conceptions. Interestingly, the presumed relationship between teachers' conceptions of science and their classroom behavior has remained virtually untested.

The data in Table 3 clearly indicated that, with the exception of "Down Time", none of the 44 classroom variables significantly differentiated between the

"high" and "low" groups. The variable "Down Time" was more common ($p < .05$) to the "low" group of teachers and it refers to instances in which students must wait for the teacher to give direction or proceed with instruction. "Down Time", in and of itself, can only be considered as a "generic" teaching behavior which is more logically related to a variety of factors (e.g., poor planning, classroom discipline, etc.) than to the teacher's conception of science. However, the most elucidating result of this investigation was the failure of those classroom variables specifically related to the nature of science (e.g., Amoral, Creative, Developmental, Parsimony, Testable, and Unified) to statistically differentiate between "high" and "low" teachers. Therefore, with the exception of the "generic" teaching variable "Down Time," the data did not support the prevalent assumption that a teacher's conception of the nature of science influences his/her teaching behavior. In addition, it is rather disconcerting that many of the classroom variables used for teacher comparisons have previously been shown to be significantly related to changes in students' conceptions of the nature of science (Lederman, 1985). The results of this investigation do not derogate the importance of a teacher's conception of the nature of science. After all, a teacher must have at least a working knowledge of what he/she is expected to teach. However, the results do indicate that simply possessing valid conceptions of the nature of science do not necessarily result in the performance of those teaching behaviors which are related to improved student conceptions.

IMPLICATIONS FOR SCIENCE EDUCATION

Teachers have been berated in the past for failure to promote adequate student conceptions of science (Miller, 1963) and are currently being strongly urged to reverse the situation (NSTA, 1982). Consequently, science educators continue to invest much time and effort in programs specifically designed to improve science teachers' conceptions (Duschl, 1985; Gallagher, 1984). Such "remedies" are based on the assumption that a teacher's conceptions influence his/her teaching behavior and that improved student conceptions will, therefore, necessarily follow improved teacher conceptions. However, the findings of this investigation clearly do not support this perennial assumption and, thus, call into question the ultimate effectiveness of our present approach to improving students' conceptions of the nature of science. Indeed, it is quite reasonable to expect that many factors (e.g., curriculum constraints, administrative policies, supplies) other than a teacher's conceptions of science influence classroom behavior. Nevertheless, research on teaching has provided strong empirical support for the relationship of selected teaching behaviors and classroom climate to a wide variety of student outcomes (Medley, 1978). More specific to the problem at hand, recent research has helped to elucidate those specific teaching behaviors which influence students' conceptions of the nature of science (Haukoos & Penick, 1983; Lederman, 1985). Consequently, it appears that a more balanced treatment of history/philosophy of science and specifically targeted teaching behaviors/skills is needed in preservice and inservice science teacher education if we are to successfully promote more adequate conceptions of the nature of science among our science students.

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APPENDIX A

Derived Classroom Variables

1. ANECDOTAL (TG) - Teacher uses (does not use) stories, analogies & examples to illustrate concepts
2. DYNAMIC (TG) - Teacher's presentation is (is not) energetic & theatrical with good voice inflections.
3. ROTE MEMORY/RECALL (TG) - Material is (is not) presented at the factual or knowledge level
4. LECTURING (TG) - Teacher talk does (does not) monopolize class time with little student involvement.
5. FREQUENT QUESTIONING (TG) - Teacher asks (does not ask) frequent questions.
6. FRAGMENTED (TG) - Teacher's presentation is (is not) "free-flowing" and logically sequential.
7. HIGHER LEVEL QUESTIONS (TG) - Higher level questions (Bloom's Taxonomy) are (are not) used frequently.
8. INSTRUCTIONAL DIGRESSION (TG) - Topics peripherally related to main concept are (are not) pursued.
9. PACING (TG) - Teacher does (does not) continually assess class understanding and adjusts pace accordingly.
10. PERIODIC REVIEW (TG) - Class time is (is not) used to review/drill students on previously presented material.
11. PREDICTABLE (TG) - Mode of presentation is (is not) inflexible irrespective of content.
12. PROBLEM SOLVING (TG) - Open ended questions and/or discrepant events are (are not) used.
13. RECEPTIVE (TG) - Teacher is (is not) receptive to student-initiated questions.
14. RUSHING (TG) - Teacher does (does not) attempt to quickly cover a predetermined amount of material.
15. SEAT WORK (TG) - Class time is (is not) allocated for written exercises or textbook reading.
16. PROBING (TG) - Follow-up questions to student responses are (are not) used.
17. SUPPORTIVE (TG) - Positive encouragement is (is not) often used.
18. HUMOR (TG) - Teacher does (does not) interject jokes and/or humorous histrionics during instructional presentation.
19. VARIETY OF MEDIA (TG) - Diverse instructional materials are (are not) used in presentation of content.
20. AMORAL (TC) - Scientific knowledge is (is not) presented as amoral.
21. ANTHROPOMORPHIC LANGUAGE (TC) - Anthropomorphic language is (is not) used and accepted by the teacher.
22. ARBITRARY CONSTRUCTS (TC) - Arbitrary nature and utility of scientific constructs are (are not) stressed.
23. CREATIVITY (TC) - Scientific knowledge is (is not) presented as a product of human imagination and creativity.

24. DEVELOPMENTAL (TC) - Scientific knowledge is (is not) presented as being tentative.
25. FALLIBILITY (TC) - Teacher does (does not) admit uncertainty with respect to content.
26. LANGUAGE ACCURACY (TC) - Exact definitions of terminology are (are not) stressed.
27. MISINFORMATION (TC) - Teacher does (does not) present misinformation.
28. MORAL/ETHICAL IMPLICATIONS (TC) - Moral & ethical implications created by science are (are not) emphasized.
29. PARSIMONY (TC) - Scientific knowledge is (is not) presented as being comprehensive as opposed to specific.
30. QUANTITY OF MATERIAL (TC) - An inordinately large amount of subject matter is (is not) presented.
31. RELEVANCY (TC) - Practical nature of subject matter is (is not) emphasized.
32. SUPERFICIALITY (TC) - Teacher's explanations of phenomena are correct but inadequate.
33. TESTABLE (TC) - The importance of empirical validation of subject matter is (is not) stressed.
34. UNIFIED (TC) - The interrelationship of various science disciplines is (is not) emphasized.
35. DEMEANOR (TA) - The teacher is (is not) pleasant.
36. IMPERSONAL (TA) - The teacher does (does not) attempt to socialize with students before or after class.
37. NON-INSTRUCTIONAL DIGRESSIONS (TA) - The teacher does (does not) tell stories totally unrelated to content being presented.
38. ACTIVE ENGAGEMENT (S) - Students are (are not) participating in lesson.
39. ATTENTIVE (S) - Students are (are not) on task for most of the class period.
40. UNSOLICITED QUESTIONS (S) - Students ask (do not ask) unsolicited questions.
41. DISCIPLINE (C) - Classroom atmosphere is (is not) highly structured and discipline oriented.
42. DOWN TIME (C) - Class time is (is not) often characterized by students waiting for next activity.
43. LOW ANXIETY (C) - Classroom atmosphere is (is not) comfortable with little anxiety.
44. RAPPORT (C) - Teacher and students do (do not) socialize and interact in a friendly manner.

Variable categories: TG: Teacher's general instructional approach; TC: Teacher's content-specific characteristics; TA: Teacher's non-instructional characteristics; S: Student characteristics; C: Classroom atmosphere.

PERFORMANCE ON A VERBAL TASK AS A FUNCTION OF TEST ANXIETY LEVEL, TRAINING, AND GENDER

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ABSTRACT

The study was designed to investigate the effects of training in progressive relaxation and strategies for solving verbal analogy problems on the performance of male and female college students as a function of test anxiety. Hypotheses suggested by arousal theory were partially supported by the results. Moderately anxious subjects experienced a performance decrement regardless of treatment, and there was a statistically significant two-way interaction between gender and treatment, with women exhibiting a performance increment and men a performance decrement in the verbal analogies training condition. The expected interaction between treatment and anxiety was not obtained, although planned comparisons between cell means revealed significant differences between moderately anxious and highly anxious subjects in the relaxation condition and between moderate- and low-anxious subjects in the verbal condition, in the predicted direction.

INTRODUCTION

There is a wealth of recent literature concerning test anxiety and the most effective ways of reducing it (e.g., Cooley and Spiegler, 1980; Decker and Russell, 1981; and Russell and Lent, 1982). A few investigators have examined the effects of test anxiety on test performance (Galassi, Frierson, & Sharer, 1981; Holroyd, Westbrook, Wolf, & Badhorn, 1978; Lekarczyk & Hill, 1969). Fewer have dealt with the effects of various methods of reducing anxiety on subsequent test performance, the usual goal of the various stress-reduction efforts (Kirkland & Hollansworth, 1980; Morris & Eagle, 1981). Denney (1980) reports in a review article that in those studies using cognitive performance as a criterion, cognitive coping techniques were much more likely to produce enhanced performance than were relaxations or self-control techniques.

Most studies, understandably, have focused on reducing the anxiety level of highly anxious subjects, while ignoring moderate- to low-anxious subjects. Reduction of anxiety is assumed to be a **desideratum**, at least for highly anxious subjects. However, arousal theory, proposed by Hebb (1955) and Leuba (1955),

posits an inverse U-shaped function between level of arousal, defined as non-specific cortical bombardment, and cognitive functioning, with the optimum occurring at an intermediate level of arousal. At extremely low and high levels of arousal, such as sleepiness and panic, cognitive functioning is at its nadir. Thus, the theory predicts an interaction between anxiety reduction and initial anxiety level such that highly anxious subjects should benefit from relaxation training, while very relaxed subjects should experience a performance decrement. Moderately anxious subjects should experience a performance decrement no matter what experimental procedure they are exposed to, provided that the procedure is effective in changing their arousal level, since any significant change from a moderate or optimal level of arousal should result in a performance decrement. In a pilot study designed to test the hypothesis predicted by the model, Buck, Arnold, and Hanna (1983) failed to find statistically significant interactions between reported anxiety level and relaxation training using cognitive performance as a criterion. However, the data suggested that with a larger sample and more stringent experimental control, the predicted interactions would be obtained.

The possible effects of other test-taking strategies are less easily predicted by the arousal model. To the extent that alternative strategies serve to reduce anxiety, the model would predict similar qualitative, although not necessarily quantitative, increments and decrements in performance as a function of initial anxiety level.

A variable seldom mentioned, according to a review by Wine (1980), in investigations of anxiety other than the special case of mathematics anxiety, is that of gender. Wine suggests that there is some evidence that women score higher on most test anxiety measures than do men. If this is the case, the arousal model would predict that women benefit more than men from strategies designed to lower arousal. The well-known gender differences in verbal and quantitative skills would suggest the possibility of gender differences with respect to different cognitive coping strategies and relaxation techniques.

The present study was designed to investigate the effects of progressive relaxation training and instruction in solving verbal analogy problems on the performance of male and female college students on a standardized vocabulary test.

METHOD

Subjects

Subjects for the first or pre-test session were 208 volunteers enrolled in 15 sections of a freshman orientation course in an historically black, public college. Post-test data were analyzed for the 131 subjects who had attended all sessions. There were 80 women and 51 men.

Materials

Materials for the pre-test and post-test sessions were the Test Anxiety Scale (Sarason, 1980) and Part I of the College Ability Test, Form 1D, which will be referred to as the TAS and CAT, respectively, in the balance of this paper. The

TAS consists of 37 true-false items such as, "I get to feel very panicky when I have to take a surprise exam" and "While taking an important examination, I perspire a great deal." Part I of the CAT, which is timed to be completed in 15 minutes, is composed of 30 five-option multiple choice items of the type, "His admiration for his father was so great that he wanted to () him in every way. A. surpass; B. dedicate; C. congratulate; D. understand; E. emulate." Test-retest reliabilities for this group of subjects were .77 for the TAS and .79 for the CAT. The correlation between the first administration of the TAS and CAT was a low and nonsignificant -.14.

For the treatment phase of the study, all groups received taped instructions read by the experimenter. Subjects who received training in progressive muscle relaxation heard a tape adapted from a commercial cassette tape (McKay & Fanning, no date available). Subjects in the verbal analogy group heard a tape describing strategies for solving verbal analogy problems while viewing the material described projected onto a screen by means of an overhead transparency projector. Both tapes and transparencies were adapted from Lewis and Greene (1982). The control group heard a tape based on portions of an article describing test anxiety in school settings (Phillips, Pitcher, Worsham, & Miller, 1980). All treatment tapes were 20 minutes long.

Answers to the TAS and CAT were recorded on commercially printed answer sheets and scored on an electronic test scoring machine, Model 550/D, manufactured by Minnesota Datronics, Inc.

PROCEDURE

The pre-test sessions were conducted during subjects' freshman orientation class periods by students from a class in research methods with the assistance of the counseling staff, who served as the instructors for the course. Students heard a tape narrated by the author outlining the purpose of the study and requesting their participation. No deception was employed, although the specific hypotheses were not revealed. Instructors offered extra credit to volunteers and provided alternative activities for those declining to participate. Participants were informed that they were free to leave the experiment at any time and all signed consent forms.

Subjects were divided into three groups based on their scores in the TAS: high, moderate, and low test anxiety. Dividing the group into thirds would have resulted in the placement of subjects with the same score in different groups; borderline cases were assigned to the middle group, resulting in initial n's of 66, 81, and 61 for the high, moderate, and low anxiety groups, respectively. Subjects with approximately equal scores were randomly assigned to one of three treatments: progressive relaxation training (relaxation), instruction in solving verbal analogies (verbal), or control.

One week after the pre-test, student experimenters read subjects' room assignments to them at the beginning of the class period, and subjects either went to another classroom in the same building or remained in their usual classroom, where they heard the first of two different tapes of one of three types:

Two weeks after the pre-test and one week after the initial treatment session, subjects heard the second tape designed for their respective groups. At the end of the tapes, subjects were given both the TAS and CAT for the second time, following taped instructions.

post-test CAT scores were analyzed by means of one-way analysis of variance (ANOVA) for unequal n's (SPSS-X), with treatment as the independent variables. These results are displayed in Table 2. Individual comparisons of means were made for treatment effects

ANOVA Summary of Table for CAT Difference Scores as a Function of Anxiety Level, Treatment, and Gender

* $p < .05$. ** $p < .02$.

and the treatment by gender interaction using Fisher's protected *t* test or least significant difference procedure (LSD). Because they were predicted by the theoretical model, individual comparisons were also made for the effects of anxiety level and for treatment by anxiety interaction, although the overall interaction was not statistically significant. Statistically significant results of these analyses are displayed in Table 3. Pearson product-moment coefficients

TABLE 3

Statistically Significant Protected t Tests (LSD) for Individual Pairs of Means

	t	df
Main Effects		
Moderate vs. Low Anxiety	-2.611*	113
Interactions		
Men vs. Women-Verbal	-2.610*	113
High vs. Moderate Anxiety-Relaxation	3.762***	113
Moderate vs. Low Anxiety-Verbal	-3.142**	113

*p < .02. **p < .01. ***p < .001.

of correlation were calculated on selected pairs of variables. The results of the correlational analysis are displayed in Table 4.

TABLE 4

Pearson Product-Moment Coefficients of Correlation (N=131) for Selected Variables

	TAS 1	TAS 2	CAT 1	CAT 2	D-CAT	Gender
TAS 1	--	.77***	-.14	-.20*	-.12	.21**
TAS 2		--	-.04	-.15*	-.19*	.22**
CAT 1			--	.79***	-.12	.00
CAT 2				--	.52***	.03
D-CAT					--	.04
Gender						--

Note. TAS 1 = First administration of TAS.

TAS 2 = Second administration of TAS.

CAT 1 = First administration of CAT.

CAT 2 = Second administration of CAT.

D-CAT = Difference score on CAT.

Gender: Males were assigned a value of 1.

Females were assigned a value of 2.

*p < .05. **p < .01. ***p < .001.

DISCUSSION

The predictions made on the basis of arousal theory were supported in part by the results, as were those results predicted by test anxiety theory more generally. It was predicted that the performance of low-anxious subjects would benefit by an increase in arousal, that high-anxious subjects would, conversely, demonstrate an increment in performance as a result of a decrease in arousal, and that moderately anxious subjects would suffer a performance decrement as the result of either an increase or a decrease in arousal. It was also suggested that, because of women's superior verbal ability and men's superior quantitative ability, there might be an interaction between gender and treatment as well as differences between men and women on the criterion. It should be emphasized here that the criterion employed a change in performance on a cognitive task. Because the TAS is a trait rather than a state measure, changes in TAS scores are of little or no concern in a study of such short duration.

The significant effect on performance of initial anxiety level lends support to the major hypothesis, in that moderately anxious subjects, regardless of treatment, experienced a performance decrement, and the other two groups exhibited increments, although only the difference between the moderately anxious and low-anxious groups was statistically significant. Although the overall interaction between treatment and initial anxiety level was not large enough to reach significance, most of the cell means were in the predicted direction. There were some puzzling trends, however, perhaps best explained by their non-significance. Both low- and high-anxious subjects showed slight gains under the relaxation condition as well as the control condition. One significant difference between cell means, high versus moderate anxiety in the relaxation condition, was predicted by the model with high-anxious subjects gaining 0.29 points compared with the moderately anxious subjects' 1.06 point decrement. In the vocabulary condition, although both high- and low-anxious subjects demonstrated an increment, and moderately anxious subjects a decrement, as predicted, only the low-anxious subjects gained sufficiently to be significantly different from the moderate group. This would suggest that the verbal analogy instruction was arousal-inducing for the low-anxious subjects and essentially neutral for the high-anxious group. Such an interpretation would be consistent with explaining the low-anxious group's relative lack of anxiety as lack of interest, and the effect of the verbal instruction as the production of positive affect and increased arousal. Extremely anxious subjects, on the other hand, were probably suffering from such a high level of chronic test anxiety that a treatment which could be viewed as ineffective in reducing that anxiety and only indirectly related to the cognitive task affected their performance only marginally.

Although there was a statistically significant interaction between treatment and gender, the only significant difference between cell means was that comparing men and women in the verbal analogy groups. Men suffered a performance decrement of 0.78 point, and women gained 2.06 points, regardless of initial anxiety level. One possible explanation for this difference is that because women tend to have verbal skills somewhat superior to those of men,

they benefited more from instruction in verbal problem-solving strategies than did the men. It should be noted, however, that the correlational analysis showed no relationship between gender and performance on the first administration of the CAT. The small, but statistically significant, trend for women to be slightly more anxious than men on the pre-test ($r = .21, p < .01$) might have resulted in their benefiting more than men from learning a cognitive strategy as suggested by Denney (1980) and by the non-significant trend in the present study for highly anxious subjects to gain somewhat more in the verbal condition than in the relaxation condition. Any attempt to explain the interaction between gender and treatment, however, must remain highly speculative. Further research on the interactions among gender, treatment, and anxiety level is strongly suggested.

The results suggest some tentative implications for the student, pending further research. It would appear that, as predicted by the model, moderately test-anxious students should probably continue to use whatever strategies they are currently using, in that all experimental intervention resulted in a performance decrement for these subjects. Low-anxious students who wish to improve their performance might consider training in test-taking strategies, accompanied by increased study; highly anxious students might do well to practice some form of relaxation just prior to taking an examination. The results suggest that women, regardless of their anxiety level, might profit from training in verbal analogies, but that men should adopt some other strategy. These suggestions are, of course, merely tentative.

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Delaware's Constitutional Amendment Process:
An Intriguing Footnote*

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Delaware stands apart from all other states in not allowing citizens an opportunity to vote directly on constitutional amendments passed by its General Assembly. This makes Delaware an intriguing footnote in the scholarly literature on state constitutions, for authors invariably cite the absence of a popular referendum but fail to explain why Delaware differs so dramatically from the rest of the country.¹ The purpose of this article is to explain why Delaware precludes voter ratification of constitutional change, a unique situation given the importance of constitutions in delineating the powers and duties of government and the rights of the people.

The Amendment Process

The Delaware Constitution can be amended by either legislative action or constitutional convention. Under the first method, amendments must pass two successive General Assemblies by a two-thirds vote before becoming part of the Constitution. If an amendment passes the first Assembly, the Secretary of State is required to publish its provisions in appropriate county newspapers within three months of the next general election. Informed voters could then judge legislative candidates on the basis of their stand on the pending amendment(s) and cast their ballots accordingly. In theory, popular discontent at the polls would compel legislators to abandon their support for controversial amendments, thus preventing final passage during the succeeding General Assembly. In this way, citizens would be exercising indirect influence over proposed constitutional alterations.²

While the General Assembly is authorized to solicit public consent for the holding of constitutional conventions, there is no mandate that the product of a convention be submitted to the voters for approval or disapproval; in fact, the current constitution, enacted in 1897, was ratified by the convention delegates without a public referendum.³

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The 1897 Constitutional Convention

The debates of the 1897 constitutional convention provide the best insight into why voters are prohibited from playing a direct participatory role in the amendment process.⁴ As is true with so much of Delaware politics, the explanation can be traced to the differences between New Castle County, which includes the City of Wilmington, and the "downstate" counties of Kent and Sussex.

The most glaring difference was (and remains today) population size. The 1890 Census confirmed what most Delawareans already knew: namely, that New Castle was the largest of the state's three counties with a population of 97,181, of whom 61,431 lived in Wilmington. In comparison Kent's population was only 32,664 and Sussex's 36,647.⁵ By 1900, New Castle had nearly sixty percent of Delaware's population, with the bulk of the people residing in the Wilmington area. Thus, in terms of population size, which political leaders were quick to equate with potential voting strength, New Castle County had a significant demographic edge over Kent and Sussex.

Matching the population imbalance was the contrast between the urban, industrial, and ethnic working-class nature of Wilmington and the more rural, agricultural, and native-born composition of the lower counties. By the same token, the city was predominantly Republican and progressive whereas lower Delaware was Democratic and politically conservative.⁶ The anti-city bias of Kent and Sussex delegates was reflected in the disparaging references to Wilmington as the great "octopus" to the north, large and wealthy, and out of touch with the downstate farming communities.⁷

Thus, a public referendum on constitutional amendments would give the politically and culturally divergent voters of Wilmington and surrounding New Castle County veto power over downstate residents. By restricting the amendment process to the General Assembly and by requiring an extraordinary majority for passage, Kent and Sussex legislators could block any constitutional proposals that threatened their interests. This defensive posture was bolstered by an apportionment plan that assigned ten representatives and five senators to each county, regardless of population size, and restricted the City of Wilmington to five representatives and two senators. As Professor John Munroe noted " ... since amendments to the constitution were to be made only by a two-thirds vote in each house in two successive assemblies, it was impossible for Wilmingtonians ever to correct this malapportionment unless they won the alliance of a good majority of the rural assemblymen."⁸

Although there was some discussion about how the absence of a referendum saved valuable time in enacting constitutional measure, practical county politics was the primary reason behind the success of Kent and Sussex delegates in limiting the amendment process to the General Assembly.

The 1968 Constitutional Revision Commission

During the reform period of the 1960s, many states attempted to modernize their constitutions.⁹ Delaware was no exception. In 1968 a fifteen-member

Constitutional Revision Commission was appointed by the Governor and the General Assembly to study and recommend a new constitutional model. By relying on a commission rather than a constitutional convention, the legislature retained ultimate control over any proposed changes. The reform effort, however, did offer political leaders another opportunity to re-examine Delaware's unique status as the only state without a popular-ratification provision for constitutional amendments.

In reality, the Commission gave scant attention to the referendum question, rejecting calls for such a mechanism on three grounds:

- a. Referendums were inconsistent with Republican Government, by which the Commission meant indirect, representative democracy. To quote one member: "Somehow or other the privilege of granting or providing to the people a chance to second-guess their elected representatives in their performance is just a little foreign to me."¹⁰
- b. Voters were generally uninterested and uninformed about constitutional amendments. Cluttering the ballot with untold propositions would confuse them even more and prolong the time needed to make necessary changes.
- c. Referendums gave power to minority factions that often prevail at the polls over an apathetic majority. For example, one State Senator was concerned that "... anytime you go to the people with a question the subversive element, the troublemakers, can really present such an effective case that John Q, plain, ordinary, head-screwed-on-right citizen, does not have a chance in these troubled times ... when everybody is against something rather than being for something."¹¹

Absent from the Commission's line of attack was any reference to the county divisions that dominated the convention proceedings of 1897. Because of the court-ordered reapportionment plans for the 1960s, Kent and Sussex counties lost significant representation in the General Assembly and no longer had the power to block a united New Castle/Wilmington coalition from passing legislation, even with a two-thirds vote requirement. Thus, failure to support a referendum could not be attributed to the objections of downstate legislators since their opposition could be overridden in the General Assembly. And, in fact, such concerns were never raised in the proceedings. The Committee focused instead on the traditional philosophical arguments made against direct democracy and the use of referendums.¹² If anything, the Commission favored a more restrictive approach towards public involvement, recommending the elimination of the newspaper notification requirement. According to the Commission, failure of the Secretary of State to advertise proposed constitutional amendments could jeopardize legislative passage, and in any case, such ads did little to inform or mobilize the electorate.¹³

In line with its commitment to representative government, the Commission recommended that the Governor be allowed to veto constitutional amendments. This provision would protect against legislative approval of poorly con-

ceived proposals, particularly during the last days of session, and, given the Governor's elected status, afford the people additional indirect influence in the amendment process.¹⁴

The Commission submitted its model constitution to the legislature in 1970. An intense four-year struggle ensued to secure enactment in which a revised bill actually passed the 126th General Assembly (1972) only to be struck down by the Delaware Supreme Court because, in an ironic twist, the Secretary of State had failed to advertise the amendments in the press prior to the fall elections. By 1974, legislative weariness with the controversy and sustained opposition from downstate Democrats to proposed changes in the judiciary led to final defeat of the constitutional reform effort. It is instructive to note that throughout the debate, few voices were heard lamenting the failure of the Commission to propose, or the General Assembly to adopt, a procedure for popular ratification of constitutional amendments.

Conclusion

The peculiar nature of Delaware's constitutional amendment process baffles outside observers who wonder why the people allow elected officials to monopolize such an important arena of political life. Yet with the exception of the 1897 constitutional convention, the referendum issue has never attracted much interest within the state. There is an almost universal consensus among legislators that the General Assembly is the proper forum for considering constitutional questions. This view applies to both upstate and downstate officials. Regardless of political geography (or political party), legislators prefer to keep the power to amend the constitution to themselves, unfettered by the vicissitudes of electoral opinion.¹⁵ The absence of any grass-roots pressure to reform the current system reinforces a perception that the public is basically satisfied with the status-quo. During the Constitutional Revision Commission hearings, for example, few community groups lobbied hard for a popular ratification mechanism.

Unencumbered by referendums, the General Assembly has been free to make constitutional alterations on the basis of legislative consensus and to enact amendments at a rate exceeding that of two-thirds of the states.¹⁶ This does not mean the legislature acts frivolously on constitutional matters, for of those amendments introduced, few pass the first legislative session, let alone the second, but the General Assembly does have the ability to move expeditiously in making constitutional revisions without the loss of time or public support that might occur in taking proposals directly to the electorate for approval. As a result, Delaware's constitutional amendment process places a heavy decision-making responsibility on law makers, but affords them greater flexibility than their counterparts in other states in adapting the constitution to changing needs. The drawback to this procedure, of course, is restricted public participation, a trade-off Delawareans are apparently willing to accept as the price for being different.

FOOTNOTES

¹For a sampling of this literature see: Charles Adrian, **Governing Our Fifty States and Their Communities** (New York: McGraw-Hill, 1978), 24; David Berman, **State and Local Politics** (Boston: Allyn and Bacon, 1981), 64; Thomas Dye, **Politics in States and Communities** (Englewood Cliffs, N.J.: Prentice-Hall, 1981), 26; Charles Press and Kenneth VerBerg, **State and Community Governments in the Federal System** (New York: John Wiley & Sons, 1979), 159; Daniel Grant and H.C. Nixon, **State and Local Government in America** (Boston: Allyn and Bacon, 1982), 114; Duane Lockard **The Politics of State and Local Government** (New York: The Macmillan Company, 1969), 93; Russell Maddox and Robert Fuquay, **State and Local Government** (New York: Van Nostrand, 1981), 33; David Saffell, **State and Local Government: Politics and Public Policies** (Reading, Mass.: Addison-Wesley, 1978), 19; Murray Stedman, Jr., **State and Local Governments** (Boston: Little, Brown and Company, 1982), 67.

²State v. Bender, 293 A. 2d. 551 (Del. Supr. Ct., 1972).

³John Munroe, **History of Delaware** (Newark, Del.: University of Delaware Press, 1979), 167.

⁴Supreme Court of Delaware **Debates and Proceedings of the Constitutional Convention of the State of Delaware 1896-1897**, Vol. IV (Milford, Del.: Milford Chronicle Publishing Co., 1958), 2393-2413, 2415-2427.

⁵Jeannette Eckman, "Government under the Constitution of 1897" in H. Clay Reed, ed., **Delaware: A History of the First State**, Vol. I. (New York: Lewis Historical Publishing Co., 1947), 307.

⁶Munroe, **History of Delaware**, 168.

⁷Debates and Proceedings IV: 2400, 2409-2410, 2412.

⁸Munroe, **History of Delaware**, 168.

⁹Albert Strum, "The Development of American State Constitutions," **The Journal of Federalism**, 12(Winter 1982), 57-98.

¹⁰State of Delaware, **Official Transcript of Proceedings of the Delaware Constitutional Revision Commission**, Vol. 37 (Dover: General Assembly, September 15, 1969), 4964.

¹¹Ibid., 4961.

¹²For the case against referendums see: David Butler and Austin Ranney, eds., **Referendums: A Comparative Study of Practice and Theory** (Washington, D.C.: American Enterprise Institute, 1978), 34-37.

¹³**Transcript of Constitutional Revision Commission**, Vol. 22, November 18, 1968, 2568, 2570.

¹⁴**Transcript of Constitutional Revision Commission**, Vol. 6, June 21, 1968, 562.

¹⁵One exception was in 1984 when the General Assembly permitted residents in each county and the City of Wilmington to vote on a constitutional amendment dealing with the operation of lotteries by non-profit service organizations within their district boundaries. This was a county/city rather than statewide referendum.

¹⁶Maddox and Fuquay, **State and Local Government**, 33-34.

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Although *Light in August* is brimful of anecdotes and character analyses, the reality, that Joe Christmas' fate and that of Joanna Burden are not self-imposed but ordained by their history, dominates the book and reaches beyond its boundaries to an unsuspecting audience.

Joe Christmas' world moves on two levels of time, the dramatic present and the recalled past, and Faulkner uses the cinematic device of the flashback to reveal the past. The reader is not introduced to Joe until after the introduction of the seemingly irrelevant Lena Grove story with its calm, unruffled atmosphere. Similarly, the reader is heaved right into the immediate present of Joe's life with a minute description of how he looked to the men at work in the planer shed. He is defined as being "definitely rootless as though no town, nor city was his, no street, no wall, no square of earth his home" (p. 27). The stage is set for the struggle of a character who is reaching out for a place in the sun but who is tormented with the unanswered question, "Am I Negro or white?" This uncertainty is the pivot of Joe's world. Although he assumes the role of both races at will, like the reader, he really does not know. He himself tells Bobbie Allen his first love, that he does not know and that he believes he has some Negro blood in him. Perhaps he is trying to test the depth of her affection, but, at the same time, he is voicing his own problem-the disturbing thought that he might be Negro.

Joe Christmas wants to assert himself, but he is confronted with a clash of worlds -- his own, versus the world around him. Alfred Kazin describes him most fittingly as "an abstraction seeking to become a human being...the most solitary character in American fiction, the most extreme phase conceivable of American loneliness". In addition, Faulkner observes, in the book, that he (Joe) thought that it was loneliness which he was trying to escape and not himself. Joe's dilemma did not just happen. Indeed, it had its origin in the lack of mother-love and understanding which dominated his early, formative years. One may try to blame the impersonality of the orphanage environment, but orphanages have produced normal, lovable human beings. Joe's undoing is the unfortunate dietician - toothpaste incident which shattered his whole world. What should ordinarily have been a comedy of errors materializes into a tragedy of rebellions.

Miss Burden's murder is already committed before we are given an insight into Joe's past, and this section begins dramatically with, "Memory believes before knowing remembers" (p. 111). It is as if Joe's memory is to be the vehicle of a revelation. With him, the reader relives his stay at the orphanage and at the McEachern's. He is only five years old, but already his fellow playmates taunt him with the word, "Nigger". However, these childish pranks pale before the dietician's outburst: "You little rat! Spying on me. You little nigger bastard" (p.

114). The child's mind cannot fathom this tirade; then Joe becomes even more perplexed when he is bribed rather than whipped. It is, indeed, paradoxical that our hero is introduced to the real world of spite, hatred and selfishness through a "harmless" exhibition of love play. His childish peaceful world has been torn apart to admit murmurings of astonishment, shock, outrage and confusion. From this point Joe Christmas is never able to strike the balance or to write it off. He learns to embrace hate and shun love with the result that he resents any overtures of kindness from everyone in general and from females in particular. Still, he falls in love with a prostitute waitress and emerges from this encounter more scathed than ever. Bobbie Allen's despicable words, "Bastard! Son of a bitch! Getting me into a jam like that, I always treated you like you were a white man, a white man!" (p. 204), set the seal on any lingering remnant of redeeming hope in Joe's sphere. His awakening is harsh, and we are told that he comes out of it "with his bloody head and his empty stomach hot, savage and courageous with whisky, to enter the street which was to run for fifteen years" (p. 204). But the respite of strong drink is merely fleeting. He can only now associate love of and for women with weakness and deception, and it is this thought which goads him to kill and to be killed.

The world of Joe Christmas undergoes the normal metamorphosis of childhood, young manhood and adulthood but, for him, each phase is dominated by a selfish, scheming female - the dietician, the waitress and the proprietrix, respectively. Culmination point is reached when he comes in contact with Joanna Burden. They are both nursing a burden which even her name seems to suggest. Like him, she is obsessed by the burden of the Negro race; he is imagined victim, and she is imagined heiress of a racial guilt. There is, therefore, an ever-present undercurrent of agony in their relationship, and this pent-up emotion erupts when Joanna deigns to try to convert her lover into the "proper kind of Negro". Joanna's grandfather had told her that the Negro race was doomed and cursed to be forever and ever a part of the white race's doom and curse for its sins. Her motive, therefore, is a selfish one, for she hopes by her actions to rid herself of her fate - assigned obligation to all Negroes. She spurs Joe to kill her, and it is not until after the murder that he finds the inner peace for which he had been groping throughout the book. He had pushed himself into it, but perhaps he had no choice, for the narrator states simply, that he had to do it.

Up until now, he has refused to identify himself as either white or Negro, but after the murder, the battle which has been raging within him ceases, and he is released from his two self-imposed contradictory worlds. Faulkner himself tells the reader it is during the interim between the murder and Joe's own capture and death, that the consuming power of the thought of the Negro blood, which he has imagined surging through his veins, loses its force. This period is for him one of spiritual retreat; he emerges from it fully aware of the nothingness and futility of his sense of guilt. His has been an unending pre-occupation with race. Even the night of the crime sees him taking a walk in both the white and the Negro sections of Jefferson. In the world of the whites he is transformed into a "phantom, a spirit, strayed out of its own world, and lost" (p. 267), while in Negro Freedman Town the ghost takes on the likeness of a 'black pit', about to engulf him. Joe's reaction to the white man's quarter with "drumming heart and glaring

lips" is most revealing. There is no denying that the white world has the stronger magnet for him, although the Negro one seems to beckon and woo him to his ultimate fate. For example, as he is wandering through the country after the murder, he bursts into a Negro cabin, and greedily consumes their prepared food. Again, he disrupts an evening service in a Negro church by standing in the pulpit and cursing God, to the chagrin of the congregation. Then events reach a climax when he exchanges his shoes for those of a Negro woman. The shoes now become a symbol of death. Faulkner gives a vivid description of the incident when he says, "the black shoes smelling of Negro: that mark on his ankles the gauge definite and ineradicable of the black tide creeping up his legs, moving from his feet upward as death moves" (p. 313).

Joe Christmas' world is one of outward calm and inward turmoil. Yet, his orbit touches almost every other character in the book. Although his path never directly crosses that of Lena Grove, they have much in common. They both arrive and lodge in Jefferson, and they have a mutual 'friend' in Lucas Burch, alias Joe Brown. This man, who abandons Lena when he finds out that she is pregnant, and who becomes both companion and foil to Joe Christmas, is the connecting link between these two characters. But the paths of Hightower and Joe merge tangibly when the former minister refuses to provide Joe with an alibi, thus giving the lie to his vocation. They have a common failing in that they are both embittered by their early disastrous experiences with the opposite sex. Hightower has grown so aloof from society that he is insensitive to the ever-present, urgent need of humanity. He is finally rewarded with the last spurt of Christmas' violence; for Joe brutally beats him, since he could only envision him as another human enemy who unconcernedly refuses to extend the hand of brother-love. By the time Joe Christmas dies, the pendulum of the reader's sympathy has completely swung his way. For the reader, he dies a martyr, free at least from his divided nature. But one feels that the burden of guilt does not die with him. It can no longer reach him. Instead, it is transferred to those who witness the death, as well as to the reader.

Faulkner's use of Christian imagery highlights the world of his hero. First, he maneuvers it so that the foundling Joe is found on Christmas Eve, and this fact prompts his surname, "Christmas". When he arrives at the home of his foster parents, the MacEachern's, the lady of the house washes his feet. Next, he is betrayed by his seeming disciple, Joe Brown, for a monetary reward. And even the day on which he murders Joanne is significant and symbolic - it is a Friday -and, ironically, he spends the week before he is brought to justice in meditation, away from the madding crowd. Finally, he is thirty-three when his mission on earth ends with his crucifixion. But the Joe Christmas - Jesus Christ analogy reaches peak point at his death scene when his "black blood seemed to rush like a released breath out of his pale body like the rush of sparks from a rising rocket" (p. 440). They both soared into the memories of their onlookers, quiet, steadfast, serene and triumphant. Above all, Joe's martyrdom, like Christ's, is a deliberate act of self-sacrifice.

They kill him gladly. Percy Grimm is the instrument and, like them, he prides himself on the fact that he has done his duty. He has rid the world of a menace. But who are we to sanction judgement? The world of Joe Christmas certainly

embodies a rebuke to the community - a measure of its sin of racial arrogance and of its corruption of Christianity from a religion of love and life, to one of hatred and death. He could not accept a mixed, impure, ambiguous world. He had to know the truth. His world literally comes full circle when he finds that the street on which he is travelling has turned into a circle. There is no escape. Everywhere there is only hatred and frustration. He is stamped with the curse of "Negro" and becomes what Quentin Compson calls "a form of behaviors" cursed by "that stain on his white blood or black blood, whichever you will" (p. 425). The choice was not his, but it could be the reader's. Joe Christmas' world does mirror the discovery of the Negro as Negro.

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HAPPY BIRTHDAY, DEAR MARTIN!!!
HAPPY BIRTHDAY
TO YOU!

by A.H. Jenkins

Scene One

SETTING: Parsonage of Ebenezer Baptist Church, Atlanta,
Georgia, 1929.

(MRS. KING, SR., is seated in chair, sewing and very pregnant. Suddenly, she winces in the pain of labor.)

MRS. KING, SR.: Aahhh! (After contraction ceases, she is pleased and calm. To her husband dozing in chair.) Martin! It's time. It's time!

KING, SR.: (Awakened suddenly, he drops the Bible in panic. Picks it up. Reverently places Bible on table to his left. At a loss, runs to and fro, aimlessly.) It's time! ... Yes, ... It's TIME!! Let's see? First, the Doctor said ... to ... uh ...??

MRS. KING, SR.: Martin, what is the weather like outside?

KING, SR.: (Runs to doors.) The Doctor said ... (Opens door. Sound of COLD WIND.) Bbrrr ... It's COLD-out there!! Now, the first thing the doctor said...

MRS. KING, SR.: Martin, put on your coat. (MRS. KING puts sewing away quietly. Calmly and methodically she prepares herself and her spouse for the trip to the hospital.) Look on the calendar and see what is today's date, dear.

KING, SR.: (Rushes to calendar.) The Doctor said ... (Carelessly glancing at a calendar on the table.) January 12th. ... the Doc ...

MRS. KING, SR.: Put on your glasses, Martin. (She crosses to calendar.) Hhmmm, JANUARY 15, 1929! A day to remember. (Crosses to Martin, to lead him out of the door.) Start the car, Martin. (Calmly puts on her coat, picks up suitcase, and locks door. Strains of **Stevie Wonder's "Happy Birthday to You"** fades up as she exits.)

MUSIC UP and OUT

BLACK OUT

Scene Two

(Seven years later. YOUNG MARTIN, JR., is in bed tossing and turning. DANCERS surround bed. Dancing in a dreamlike frenzy. DANCERS exit abruptly as:)

MARTIN, JR.: (Moaning.) OOohhh! Ooohh! Ooohh!

MRS. KING, SR.: (Rushes into bedroom.) What is it son? What is it??

MARTIN, JR.: (Sitting up.) Oh, Mama! I had a dream! ... I HAD A DREAM!!!

BLACK OUT

Scene Three

(Nervously, Martin, Jr. and a BEST FRIEND are standing waiting.)

MARTIN, JR.: I'm scared! I tell you! I've never been so frightened in my life!!

BEST FRIEND: Aw, Martin! There's nothing to be afraid of. Why, 1,367 people, all over the world, do this same thing every fifteen minutes.

MARTIN, JR.: I just don't understand it. I was captured. I had no say, no will of my own!

BEST FRIEND: SSshhh! Here she comes. She is a vision. I have never seen Coretta look lovier! (CORETTA walks toward the two men, in step with the strains of a WEDDING MARCH. DANCERS form the Wedding Party and gaily sprinkle flowers, etc.)

BLACK OUT

Scene Four

(MARTIN, JR. is talking on the telephone. His BEST FRIEND is seated.)

MARTIN, JR.: ...They did what!! Why, those sin-sick-sons-of-discrimination!

BEST FRIEND: (At the sound of the urgency in KING'S voice, puts down the newspaper he has been reading.) What is it!

MARTIN, JR.: Rosa ... Rosa Parks! ... And a Bus Driver!! (Into telephone.) She did?

(DANCERS pantomime scene of Rosa Parks refusing to give up her seat and go to the back of the bus.)

BEST FRIEND: What???

MARTIN, JR.: (Thoughtfully.) You know, I had a ... (To his friend.) She wouldn't go to the back of the bus!! ... in ALABAMA!!

BEST FRIEND: Uh - oh!!

MARTIN, JR.: You know, this was something like that dream when I was young and ... (His voice trails off.)

Scene Five

(MARTIN, JR. and BEST FRIEND lead DANCERS in simulation of the 1963 MARCH ON WASHINGTON.)

MARTIN, JR.: (Taking off hat and wiping brow.) It's a beautiful day for a MARCH!

BEST FRIEND: I saw ... (Overwhelmed.) I saw Wilt Chamberlain! CLOSE UP!! (Looks skyward.)

MARTIN, JR.: (REMINISCING.) Yes. A beautiful day! You know, when I was seven years old, I had this dream ...

BEST FRIEND: (Excited) ... and LENA HORNE! Everybody for jobs, peace and freedom are here.

MARTIN, JR.: That's it!! That's what I'll do!! I'll tell everybody. Today I will describe in detail this dream I have!!

(A portion of the recording, "I HAVE A DREAM" fades up.)

BLACK OUT

Scene Six

(DANCERS enter; perform dance portraying preparing to "Travel". It is 1963. Bedroom of the MARTIN LUTHER KING'S. They are packing suitcases for the trip to Oslo, Norway to receive the NOBEL PEACE PRIZE. Dancers exit as CORETTA speaks.)

CORETTA: Where did you put your black-tie?

MARTIN: In the pocket of my tuxedo jacket.

CORETTA: I suppose that is as good a place as any. How do you feel? Are you excited? I am. Why, it is a gift from God, THE NOBEL PRIZE FOR PEACE. YOLANDA; YOUNG MARTIN; DEXTER; BERNICE and I ... we are so proud and happy for you.

MARTIN: Well, I can think of many more deserving people. There's SHUTTLESWORTH, and ABERNATHY and ...

(As if talking to a real person.) Also, Norway. Do you know what I'm going to tell Your Majesty, Your Royal Highness, Mr. President, Excellencies, ladies and gentlemen?

I accept the Nobel Prize for Peace at a moment when twenty-two million Negroes of the United States of America are engaged in a creative battle to end the long night of racial injustice. I accept this award in behalf of the civil rights movement which is moving with determination and a majestic scorn for risk and danger to establish a reign of freedom and a rule of justice.

CORETTA: The people of the world are going to remember those words. Martin, we've lived a life of struggle for equality, with the faith that our children and millions after us will live their lives in pride. All races, all religions, all cultures will be free from violence, poverty and war so that all may live together in the beloved house of the World. I am so proud of you, my darling. From your dream to THE NOBEL PRIZE FOR PEACE.

(DANCERS re-enter; complete "Travel" dance sequence.)

BLACK OUT

Scene Seven

(DANCERS enter; perform "Church" sequence. It is APRIL 3, 1968. MEMPHIS, TENNESSEE. As MARTIN speaks from the pulpit.)

MARTIN: And then I got into Memphis. And some began to say the threats ... or talk about the threats that were out. Or what would happen to me from some of our sick white brothers. ... Like anybody, I would like to live a long life. Longevity has its place. But I'm not concerned about that now. I just want to do God's will. And He's allowed me to go up to the mountain. And I've looked over, and I've seen the promised land. I may not get there with you, but I want you to know tonight that we as a people will get to the promised land. So I'm happy tonight. I'm not worried about anything. I'm not fearing any man. Mine eyes have seen the glory of the coming of the Lord.

(DANCERS end "Church" sequence.)

BLACK OUT

Scene Eight

(It is APRIL 4, 1968. DANCERS enter onto a simulation of the balcony of a

Memphis motel. Gun shots!! MARTIN, JR. falls! DANCERS dance a "murderous panic" sequence and exit as: BEST FRIEND rushes to MARTIN.)

MARTIN, JR.: Stop! Everyone please stop! Remember ... It really doesn't matter with me now. Because I've been to the mountaintop!! I don't mind. (A portion of prophetic speech in the church fade up and under.) Jesse ... Jesse. Where is that young, stubborn, idealistic go-getter?

JESSE: (Crossing to MARTIN.) Here I am, Martin.

MARTIN, JR.: Jess, to believe in a dream is nothing unless, we do all we can to achieve that dream.

JESSE: I know, Martin. You're right. Someone call an ambulance! OUR TIME HAS COME!

(A portion of Jackson's Speech at the 1984 Democratic Convention fades up.)

(DANCERS enter and complete the FINALE!)

BLACK OUT

THE END

POSSIBLE LEAD POISONING IN AN AMERICAN BALD EAGLE An Improved Method for Determining Low Lead Levels in Blood

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INTRODUCTION

On December 31, 1985, there were six remaining bald eagles and three active bald eagle nests in the State of Delaware. During January, 1986, one of the remaining six birds was found injured and near death. (1) X-rays indicated the presence of 8 to 10 lead pellets lodged in the bird, apparently from old wounds. The bird had a broken wing and might never have flown again. One of many medical questions to be answered was the possibility of lead poisoning due to the pellets. The Department of Chemistry at Delaware State College was asked to determine the lead content in a small (3 ml) blood sample obtained from the bird. The department had already been investigating improved methods for determining the lead content in blood, for as industrial sources of lead pollution increase, so does the importance of detecting its ingestion. A recognized method of analysis was developed by Jarrell-Ash Division of Fisher Scientific Company and others which relied on air oxidation at relatively high temperatures for relatively long periods of time to minimize background absorption by organic materials present in whole blood. The authors found the effectiveness of air oxidation on organics inconsistent and inadequate. The purpose of this research was to develop alternate procedures for overcoming these problems.

METHOD

The lead content of whole blood was determined by flameless atomic absorption spectroscopy using two percent nitric acid to oxidize organics in the ashing stage, and an argon purge throughout the cycle to prevent air oxidation of the carbon rod atomizer. Temperature and times used in this procedure were minimized to prevent unnecessary thermal rod deterioration.

MATERIALS

Reagents and Apparatus

- Distilled water - Doubly distilled and deionized
- Nitric acid - two percent in distilled water
- Atomic absorption spectrophotometer-Jarrell-Ash Model 810, Operating conditions: Mode, A-B; absorbing line, 2833A; non-absorbing line 2820A; slit widths, 2A; recorder, 10 millivolts full scale with a 1-second response time.
- Graphite tube furnace and power supply - Fisher Model FLA-10. Operating conditions: Mode, Auto 1*, dry cycles, 10 amps (200C.) for 20 seconds; ash cycle, 40 amps (7100 C.) for 30 seconds; atomize cycle, 180 amps (2200 C.) for 120 seconds.
- Three ml sample of blood from an American eagle. The sample was presented by the Bombay Hook Wildlife Refuge.

PROCEDURE

A small sample of whole blood was diluted to 1/10 with distilled water and 10 ul were injected into the carbon rod. The power supply was started and stopped after a dry cycle. Twenty ul of 2% nitric acid were injected into the carbon rod and the power supply was restarted. The heights of the resulting peaks were measured.

RESULTS

The superiority of the modified method of nitric acid oxidation vs. the method involving air oxidation was demonstrated by carrying out parallel determinations on the same blood sample. The comparison of the results obtained is shown in Table 1. The smaller average background signal indicates that chemical oxidation is more efficient than air oxidation and the smaller deviations in both lead and background signals indicate that chemical oxidation is also more consistent than air oxidation. The rods used in the procedure were also weighed before 50 lead determinations. The rod used for the air oxidation method experienced a weight loss of 4.62% while the rod used for the chemical oxidation method lost only 2.78%. Allowing ample time for pipeting (15 seconds), the air oxidation method required 145 seconds per analysis while our modified method required only 100 seconds. The improvements over the air oxidation method by the chemical oxidation method are shown in Table 2. This method is

TABLE 1
COMPARISON OF METHODS OF LEAD
ANALYSIS IN WHOLE BLOOD

TRIAL	AIR OXIDATION		CHEMICAL OXIDATION	
	ABSORBING LINE (CHART UNITS)	NON ABSORBING LINE (CHART UNITS)	ABSORBING LINE (CHART UNITS)	NON ABSORBING LINE (CHART UNITS)
1	33.5	2.5	37.5	3.0
2	32.0	5.0	30.0	6.0
3	39.0	4.5	36.0	7.0
4	41.0	4.0	35.5	7.5
5	35.0	2.5	32.0	7.5
6	17.0	53.0	30.5	5.0
7	25.5	28.0	24.5	5.0
8	22.0	45.0	21.5	5.0
9	27.0	46.5	29.0	7.5
10	44.0	5.5	31.0	4.5
11	53.5	7.5	39.0	7.5
12	28.0	2.0	27.5	12.5
13	47.0	7.0	36.0	6.0
14	46.5	4.5	34.5	11.5
15	46.5	5.0	31.5	6.0
AVG.	35.8	14.8	31.7	6.8
DEV*	± 5.9	± 10.2	± 2.7	± 1.4

* AT THE 95% CONFIDENCE LEVEL

TABLE 2
RESULTS IMPROVEMENTS
OVER JARRELL-ASH METHOD

DECREASED WEIGHT LOSS BY.....	32%
DECREASED DEVIATION FROM THE MEAN BY.....	54%
DECREASED TOTAL ANALYSIS TIME BY.....	24%

compared to an acceptable procedure for the determination of lead in whole blood by Jarrell-Ash Division of Fisher Scientific Company, et. al. (2)(3)(4) and shown to decrease weight loss of the carbon rod due to chemical and thermal deterioration by 32%, decrease deviation from the mean at 95% confidence level by 54%, and decrease time required for analysis by 24%.

The above procedures were applied to determine the lead content of a blood sample obtained from an American bald eagle. Aqueous standards were added to the actual blood samples to correct for matrix effects. The sample was run in duplicate. Good linearity was obtained when peak heights were compared to lead concentrations (see figure 1). The lead content in the blood sample was

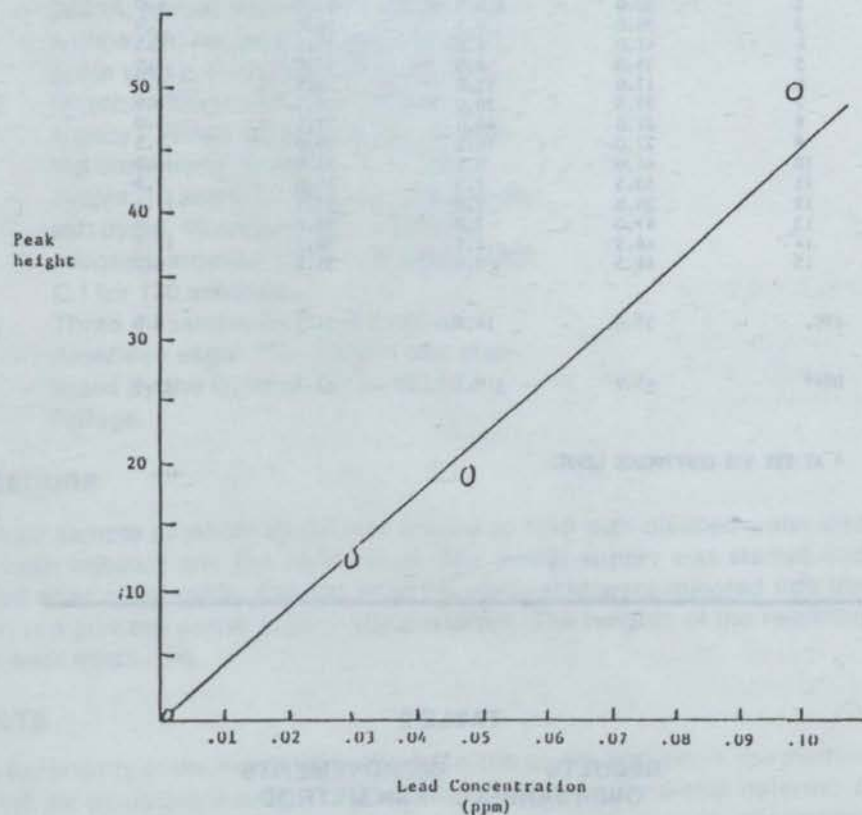


FIGURE #1

found to be 5.3 ppm for an average of 5.2 ppm. Repetitive analysis of blood samples by this technique indicated an average of 5.2 ppm with a standard deviation of 0.54. One can be 96% confident that this blood sample contains anywhere from 4.1 ppm to 6.3 ppm lead.

The toxic level for lead in humans is 0.7 ppm. Although the toxic level for eagles is not known, it seems that a level 7.4 times the toxic level in humans must have been harmful to the bird. Lead poisoning due to the use of lead shot is an ever present danger to all birds. Delaware now has five healthy bald eagles. Last

year there were six. Results from the present study suggest that wildlife conservation experts must seriously consider the effects of yet another life-threatening condition -- lead poisoning.

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TEACHER'S CONCEPTIONS OF THE CONTEMPORARY GOALS OF SCIENCE EDUCATION

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ABSTRACT

This study was initiated to examine what middle and high school science teachers believe should be the goals of science education for the remainder of the 1980's. Participants were given a questionnaire that had at one extreme, statements reflecting 1960's goals and at the other extreme statements corresponding to modern science education goals. Additional information such as year of degree, grade level taught, and attendance at workshops was compiled. The results of this survey indicated a lack of commitment to modern goals from the majority of respondents. However, when only those responses indicating a preferred goals orientation were considered, teachers expressed predilection towards 1980's goals. Furthermore, those teachers who favor 1980's goals felt stronger in their conviction than teachers expressing a 1960's goals preference. A discriminant analysis was employed to study whether or not differences in definitive 1960's or 1980's views were associated with one or more items on the personal data questionnaire. It was found that a combination of teaching middle school grades (6-8) and attending more in-service workshops is moderately associated with an eighties orientation to the goals of science education. The results of the study lead the authors to recommend that a concerted effort be made by professional organizations to convey the importance of contemporary goals to teachers at the high school level. Additionally, an effort should be made to disseminate these goals through local seminars and workshops.

Public opinion has, historically, had great impact on education reform. At no time was this more evident than the rush to modify science curricula in the wake of the Sputnik launch of 1957. The goals for science education in the 1960's were characterized by an emphasis on processes and techniques designed to produce scientists (Anderson, 1983; Johnson, 1966; and Boulos, 1964). This curriculum reform era spawned hands-on activities and process skills that emulated the scientific endeavor. There was little concern for the interrelationship of science, technology and society. With the advent of the Project Synthesis document (Harms, and Yager, 1978) and the subsequent realization that a

true crisis existed in science education, further reform seemed necessary. Science educators have advocated new goals that address today's need for a scientifically and technologically literate populace (Hofstein and Yager, 1982). Additionally the National Science Teachers Association (NSTA) has issued a position statement on the role of science, technology and society for the 1980's (NSTA, 1983).

Throughout the discipline a major redirection of goals is taking place. In the 1960's, goals were established and communicated to the classroom teacher principally by way of workshops, in-service programs and journal articles. In the 1980's, however, federal monetary support has substantially diminished and few workshops and in-service programs are currently being offered. The dissemination of goals is relegated primarily to the print media and meetings of professional organizations concerned with science education. With this in mind, it seems appropriate not only to assess the effectiveness of these efforts in communicating the contemporary goals of science education but also to assess the conviction with which these goals are held by the classroom teacher.

This descriptive study was conducted to address that issue. A contemporary goals survey was designed to evaluate the relative emphasis that middle and high school teachers in the state of Delaware place on the science teaching goals of the 1960's as compared to the goals of the 1980's, particularly with respect to the relationship of science and technology to society.

THEORETICAL BASIS (RATIONALE)

A review of the literature, available through the ERIC data base, by the authors prior to the initiation of this research revealed only one article related to assessing teachers' perceptions of the goals of science education of the 1980's (Berkeimer, 1984). The population in this study was science education faculty and graduate students. It seemed a logical outgrowth to extend this research to middle and high school teachers to assess their perceptions of the contemporary goals.

PROCEDURE

Instrument

An eight-item bipolar scale which reflected the major goals of science education for the 1960's and 1980's was derived from NSTA position statements and modeled for Kyle (1984). At one end of the continuum for each question was a statement reflecting a predominately 1960's orientation while the opposite end was one representing a 1980's emphasis. Teachers were asked to choose one of seven spaces on the continuum for each question that best described the emphasis that they felt should be placed on the goals of science education for the last half of the 1980's. Content validity was established by sending the questionnaire to six prominent teachers and researchers in science education who hold (or have recently held) elected positions in NSTA or National Association for Research in Science Teaching (NARST), and have contributed to

science curriculum goals. Those experts were asked to evaluate the relevancy of the items with respect to the 1960's and 1980's goals of science education. Their suggestions were compiled and a final revised questionnaire constructed (see Table 1).

The order of items beginning with a particular orientation was randomly varied. Included on the questionnaire were items which elicited additional information relevant to variables in this study (e.g., year of undergraduate-/graduate completion, number of state, national, in-service workshops attended in last four years). Test-retest reliability was determined to be .75 (Spearman Rank, $n=26$) using public school teachers.

The sample consisted of all middle (6-8) and secondary (9-12) school science teachers in the state of Delaware. After an initial mailing of 307 questionnaires, and follow-up letter, the return rate was 47%. The total number of those who provided complete information on which subsequent data analyses was based was 113 subjects. The final sample constituted a cross section of Delaware teachers with all counties and grade levels amply represented.

RESULTS

Part I

To provide an overview of the results of this study, a descriptive analysis of the questionnaire was undertaken. Response frequencies and percentages were tabulated for each statement category (see Table II). Observation of total frequencies for the questionnaire reveals that the "equal emphasis" response was chosen 33.9% of the time. Respondents most frequently indicated a preference that contemporary science instruction should provide equally for the goals of the 1960's and the 1980's.

TABLE II
RESPONSE FREQUENCIES AND PERCENTAGES (In Parentheses)
FOR THE CONTEMPORARY GOALS SURVEY

Statement Number	1960's Goal Orientation			Equal Emphasis	1980's Goal Orientation		
	Strong	Moderate	Slight		Slight	Moderate	Strong
1	1 (0.9)	12 (10.0)	6 (5.3)	40 (35.5)	9 (8.0)	15 (13.3)	30 (26.5)
2	5 (4.4)	17 (15.0)	8 (7.1)	36 (31.9)	7 (6.2)	18 (15.9)	22 (19.5)
3	1 (0.9)	8 (7.1)	8 (7.1)	42 (37.2)	12 (10.6)	17 (15.0)	25 (22.1)
4	22 (19.5)	32 (28.3)	16 (14.2)	35 (31.0)	3 (2.7)	1 (0.9)	4 (3.5)
5	7 (6.2)	12 (10.6)	12 (10.6)	60 (53.1)	6 (5.3)	6 (5.3)	10 (8.8)
6	17 (15.0)	26 (23.0)	6 (5.3)	48 (42.5)	1 (0.9)	9 (8.0)	6 (5.3)
7	6 (5.3)	14 (12.4)	10 (8.8)	22 (19.5)	12 (10.6)	22 (19.5)	27 (23.9)
8	5 (4.4)	15 (13.3)	12 (10.6)	23 (20.4)	14 (12.4)	22 (19.5)	22 (19.5)
Total Questionnaire	64 (7.1)	136 (15.0)	78 (8.6)	306 (33.9)	64 (7.1)	110 (12.2)	146 (16.1)

The second most frequent response choice was that indicating a strong 1980's orientation (16.1%). A strong 1960's orientation was least favored (7.1%). The exceptions to this pattern occurred in statements 4 and 6 and, upon closer examination, these statements are revealing. For example, the 1980's position is

TABLE I
CONTEMPORARY GOALS SURVEY

Directions: Check one space on the continuum that you believe best describes the emphasis that should be placed on the goals of science education for the last half of the 1960's.									
1. Science education courses should be primarily designed to produce more scientists and engineers to solve scientific problems.	Strong	Moderate	Slight	Equal Emphasis	Slight	Moderate	Strong	Science education courses should be primarily designed to familiarize all students with the interaction of science, technology and society.	Strong
2. The most important knowledge that a science student should have are those facts, concepts and principles that represent the structure of the discipline taught.	Strong	Moderate	Slight	Equal Emphasis	Slight	Moderate	Strong	The most important knowledge that a science student should have are those facts, concepts and principles that add to the solution of social and technological problems.	Strong
3. The major focus of science education should be geared to preparing future citizens.	Strong	Moderate	Slight	Equal Emphasis	Slight	Moderate	Strong	The major focus of science education should be geared to the training of future scientists.	Strong
4. In addition to knowledge acquisition, science education should focus upon student experiences with processes such as inferring, identifying variables, etc.	Strong	Moderate	Slight	Equal Emphasis	Slight	Moderate	Strong	In addition to knowledge acquisition and process skills, science education should focus upon the affective domain, including ethical and aesthetic experiences.	Strong
5. Science education should emphasize decision-making skills that demand divergent thought processes that seek to examine interrelationships between and among environmental systems.	Strong	Moderate	Slight	Equal Emphasis	Slight	Moderate	Strong	Science education should emphasize inquiry skills that demand those logical, convergent thought processes that are associated with the "scientific method" used in investigation.	Strong
6. Science education should be construed as a discipline that is concerned with the resolution of future societal problems.	Strong	Moderate	Slight	Equal Emphasis	Slight	Moderate	Strong	Science education should be construed as a discipline that contributes greatly to our present understanding of the world in which we live.	Strong
7. Contemporary goals of science education should differ within each discipline (biology, chemistry, etc.). That is they should be intrinsically defined by the nature of the subject area.	Strong	Moderate	Slight	Equal Emphasis	Slight	Moderate	Strong	Contemporary goals of science education should be interdisciplinary in nature and defined by the interaction between science, technology and society.	Strong
8. Science should be presented as a value laden subject that has both moral and ethical dimensions.	Strong	Moderate	Slight	Equal Emphasis	Slight	Moderate	Strong	Science should be presented as value-free, without moral or ethical issues, in and of itself.	Strong

similar to the 1960's position except that the former includes the notion of affective, ethical, and aesthetic experiences. In statement 8, however, science teachers responded favorably to the inclusion of ethical and moral considerations as possible goals. It must be the case that affective and/or aesthetic components are the most resistant to acceptance since participants summarily rejected this orientation in statement 4. Question 6 compares the issue of addressing future societal problems versus present understanding of the world. It was found that 15% indicated strong support for the latter while only 5.3% indicated strong support for a discipline concerned with the resolution of future societal problems. The orientation of a 1960's position in statements 4 and 6 becomes even more obvious if one collapses the categories on either side of the "equal emphasis" position (see Table III). The combined frequencies, indicating a 1960's position, demonstrate that a resounding 62% of respondents rejected the inclusion of affective and aesthetic goals. Question 6 also becomes more informative, with 43.3% indicating that science teaching goals should stress **present** understanding of the world rather than the resolution of future societal problems (14.2%). It should be noted that this percentage is greater than that indicating that both positions should at least have equal emphasis. Including anomalous statements 4 and 6, the total percentages in Table III indicate a rather even distribution between 1960's and 1980's orientations, with the 1980's position being slightly favored. If, however, statements 4 and 6 are removed from consideration, a decidedly **1980's** position is taken (see last row of Table III).

TABLE III
COMBINED RESPONSE FREQUENCIES AND PERCENTAGES (In Parentheses)
FOR THE CONTEMPORARY GOALS SURVEY

Statement Number	1960's Goal Orientation	Equal Emphasis	1980's Goal Orientation
1	19 (16.8)	40 (35.4)	54 (47.8)
2	30 (26.5)	36 (31.9)	47 (41.6)
3	17 (15.1)	42 (37.2)	54 (47.7)
4	70 (62.0)	35 (31.0)	8 (7.1)
5	31 (27.4)	60 (53.1)	22 (19.4)
6	49 (43.3)	48 (42.5)	16 (14.2)
7	30 (26.5)	22 (19.5)	61 (54.0)
8	32 (28.3)	23 (20.4)	58 (51.4)
Total Questionnaire	278 (30.7)	306 (33.9)	320 (35.4)
Totals with Statement Numbers 4 and 6 Omitted	159 (23.4)	223 (32.9)	296 (44.0)

It was also of interest to consider a "strength of conviction" index of those **not** responding with the equal emphasis choice. This would indicate how **strongly** those favoring a particular goal statement felt about their selection. To provide this index, numbers were assigned to the category positions and a weighted mean was calculated for each of the collapsed categories in each statement. The deviation of this score from the equal emphasis position revealed the relative strength of preference for either 1960's or 1980's goals (see Table IV). The mean 1980's deviation (2.3) was shown to be greater than the mean 1960's deviation (1.9). This was true for each statement in the survey except item 4. Although it was shown previously that the majority felt that aesthetic issues should not be included in a science class, those participants that expressed disagreement with the view felt equally strongly that these issues should be included as goal statements. It is also worthy to note that while the majority viewed a 1960's approach to statement 6 to be most favorable, those indicating a 1980's preference felt just as strongly about their selection.

Part II

The sample was divided into two groups, those who completed their undergraduate degree on or before 1969 and those who finished on or after 1970, on the premise that the different pedagogical emphasis of those two decades might have bearing on teachers' present conceptions of science education goals. Group means for each statement were plotted and a profile analysis using the one tailed probability sign test was performed. This test revealed and indicated that no significant differences ($p \leq .14$) were exhibited between groups. Although one may have expected those teachers who completed their B.S. on or after 1970 to have consistently greater means (1980's orientation) than those before 1970, this analysis indicated that **neither** group displayed a predominant preference for either orientation (60's vs. 80's). When the sample was divided into two groups based upon the year that they completed their graduate master's degree (≤ 1969 vs. ≥ 1970), the same results were found. (It should be emphasized that some of those in the latter group division are the same subjects as in the former group division).

Part III

Inasmuch as a different pattern was revealed in Part I when non-committal (equal emphasis) responses were eliminated from the analyses, discriminant analysis was employed to study whether or not differences in definitive 1960's or 1980's views were associated with year of undergraduate degree completion, grade level taught, attendance in state, national and in-service workshops. The stepwise method for selection of variables was Rao's V, which maximizes separation of group centroids (in this case - 1960's vs. 1980's orientations). It was found that grade level taught [middle (6-8) vs. secondary (9-12)] and attendance at in-service workshops, formed one significant canonical discriminant function ($X = 13.13$, $df = 4$, $p \leq .01$). Each of these variables significantly increased Rao's V ($p \leq .01$ and $.05$ respectively) which represents an increase in

overall separation of group centroids (1960's vs 1980's orientations). Furthermore, these variables correctly predicted 72% of those teachers composing a 1960's orientation and 67% of those with a 1980's one ($n = 99$). Interestingly, the canonical discriminant function coefficients (.59 and .46 respectively) would suggest that they are moderately related to contemporary goal orientation. Specifically, a combination of teaching **middle** school grades (6-8) and attending **more** in-service workshops is moderately associated with an **eighties** orientation to the goals of science education.

IMPLICATIONS AND LIMITATIONS

The descriptive data suggests that the majority of science teachers in Delaware believe, with two exceptions, that science education goals commonly associated with a 1980's perspective should be emphasized to some degree in a contemporary science class. The two exceptions emerged from analysis of the response frequencies attributed to statements 4 and 6 of the contemporary goals survey. Respondents in the former statement rejected affective goals and aesthetic experiences in the science classroom. In the latter statement these same respondents indicated that the resolution of future societal problems is a less appropriate goal than understanding the world as it is today.

Efforts by national organizations and prominent educators seem at first glance to have been successful in sensitizing science teachers to such modern day goals as the interaction of Science, Technology, and Society (STS). It is disconcerting, however, that science teachers hold affective and aesthetic experiences in such low regard. Surely a true understanding of STS issues lies in the appreciation of the environment that we seek to preserve by addressing these issues. Perhaps a more concerted effort might be made to at the national level, address affective goals. National Science Teachers Association publications, such as *Science and Children* and *The Science Teacher*, seem to be appropriate mediums for conveying contemporary goals of science education. Of the 113 teachers surveyed, 29% read these journals on a regular basis while 45% reported they occasionally read them.

Science teachers who were given a choice indicated that they would prefer to emphasize science as a vehicle for understanding the modern world rather than as a means of resolving future societal problems. While the preferred position is debatable, individuals or organizations may find this information useful when considering prevailing goals orientation. Furthermore, those science teachers professing a 1980's orientation demonstrated a stronger conviction for their position than those with a predominately 1960's disposition. Apparently contemporary goals are important to those who embrace them. Goal setting agencies should not abandon their sense of urgency, particularly in light of the fact that 19% to 53% of the teachers (depending upon the item) choose the equal emphasis category. This finding demonstrates either a lack of conviction or possibly a lack of conceptual understanding of past and present goals.

It is of interest to note that middle school teachers tended to have an 1980's orientation while high school teachers a 1960's orientation (as indicated in part

III of the results). Perhaps high school teachers are more "content conscious" with little time to treat the subject matter as a unified discipline. This suggests that a concerted effort by professional organizations such as NSTA, NARST or AETS (Association for the Education of Teachers of Science) is needed to help convey contemporary goals to the secondary school teacher. According to the results of the present study, an effort made to disseminate the goals on the local level (particularly within the context of in-service workshops) would appear to have a facilitative influence on teachers' perceptions of contemporary goals. A potential threat to the validity of any survey lies in the return ratio of the questionnaire that was distributed. The typical response of a mailed questionnaire is 20-40% (Nachmias and Nachmias, 1976). While the 47% return rate obtained in this study compares favorably with this statistic, there is always a question as to what the non-respondent could be withholding. The authors recognize that this consideration represents a possible limitation to this study.

Since this study was conducted within the state of Delaware, the question may arise as to whether the findings will generalize to public school teachers from other states. Consequently, while the present claims are based upon the current sample, one is at a loss to think of any compelling arguments as to why teachers in Delaware would **not** be representative of teachers in any other state; for this sample consisted of teachers ranging from city to rural school districts.

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