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ASSESSMENT OF TECHNOLOGY: NEED, BENEFITS AND PROBLEMS

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Technology is, and has always been, an essential component of society. It is essential to human life processes but also the source of serious problems. Because of the problems that have been associated with the adoption of technological innovations, society has always had to develop some means of controlling and directing technologies. In the past, prior to the twentieth century, approaches to controlling and directing technologies had been ad hoc, local, fragmental and mobilized only after crises or catastrophes had befallen men. This appraoch of control, while it allowed substantial hardships to develop on significant numbers of people, was nevertheless an approach which minimally served a world changing slowly and possessing relatively weak technological powers.

In the twentieth century such an approach is inadequate, and inappropriate for several reasons. First, new technologies advanced and diffused in recent decades are large in scale requiring huge investments, involving long periods of planning and engendering intractable if not irreversible consequences. It has become important consequently to consider at the planning stage any incidental or secondary effects that the technologies may have. The cost of correcting an undesirable side effect is far higher than designing the effect out of the system at the beginning. Second, not only are the new technologies large in scale, they also have exhibited vast amounts of power to alter society and affect the environment on a scale previously unknown. This power derives partly from the interlocking nature of the new technologies. Third, there is a trend of diminishing lead times between technological innovation and widespread diffusion and application leaving less time to make analysis and adjustment. Error is ever more dangerous and costly. The phenomenon of diminishing lead times reduces the probability that ad hoc, fragmented, self-interested effort will adequately control negative effects and maximize the potential of positive effects. Fourth, all these new technologies are being developed, diffused and applied in societies becoming increasingly large in size in terms of their populations and also increasingly complex in terms of the interconnectedness of their various elements. The social institutions of society have become so interwoven and interdependent that a disaster in a single component may create havoc throughout the entire society.

The picture presented here is a world of potential technologies, advancing human choices at exponential speeds, applied with ever decreasing lead times in social systems (societies) of increasing size, differentiation and complexity making for varied, subtle and far reaching impacts. To a greater extent than in the past even small errors can create disastrous problems affecting large numbers of people over greater space and time. In a world like this, adverse effects can be too devastating to await their emergence. This fact has prompted urgent recent concern about the neces-

sity to develop mechanisms of Technology Assessment. Technology Assessment is thus a "seasoned response to the stress that a rapidly changing and expanding technology puts on our complex and increasingly industrialized, urbanized and densely populated society" (Kiefer, 1971).

The purpose of this paper is to discuss what technology assessment involves and to point out some of the problems, some methodological, other substantive, that stand to detract from the establishment of effective assessment.

Technology Assessment is defined as the systematic study of the effects on society that may occur when a technology is introduced, extended or modified (Coates, 1971). It is an attempt to develop a mechanism to forecast the potential effects of a new technology and thus be able to decide if it is worthwhile for society to adopt it. It is different and broader than activities such as market research, investment analysis, program planning, systems analysis or cost-effectiveness studies. It is different in the sense that it has a technology--specific futuristic orientation. It is broader in that it focuses on more than just the direct or primary effects. It places special emphasis on the impacts/effects that are secondary, tertiary, unintended, indirect or delayed. It focuses on "the interactions, side effects, by-products, spillovers and tradeoffs between a new technology and society at large and the environment" (Keifer, 1971). Technology Assessment, in other words, adds indirect or second or higher order effects and social impacts to the cost-benefit equation. It asks the question "what else may happen but be overlooked, whether beneficial or harmful, when technology is introduced?" There are two reasons for the emphasis on higher order impacts. The first is that usually first-order impacts are subjected to intensive and extensive study and planned for early in the development of a new technology because they are the direct objective of the technology. The second is that in the long run higher order effects may affect society more deeply than the intended primary effects, yet if they are unwanted they can be controlled or removed more easily if they are identified early in the development process.

Jerome Weisner (1972) describes Technology Assessment as an early warning system to protect man against his own inventions. And Alvin Toffler (1972) warns that unless we probe ahead in time with all our intelligence and imagination by developing such a warning system we may be compelled to endure an undesirable future. This view of Technology Assessment as a warning system, while correct, is limited. Assessment may properly be viewed as "a mixture of warning signals and visions of opportunity; as a device for protecting man from his own technological creativity or as a formal mechanism for allocating scientific resources, setting techno-

logical priorities and seeking more benign alternatives for technologies already in use, or as an attempt to control and direct emerging technologies so as to maximize the public benefits while minimizing public risks" (Kiefer, 1971).

As a result of Assessment, a technological project may be cancelled or abandoned, or it may be modified to make it more useful, safer, effective or aesthetically satisfying. It may proceed, but a monitoring system may be instituted to determine the consequences of the project to forestall any deleterious side effects. Assessment may stimulate new research and development to define more reliably the risks indicated by the assessment, to find alternative methods of meeting the original need without the negative effects or to find corrective measures to deal with adverse effects. Assessment may suggest that a proposed technology promises major potential benefits and should therefore be applied in other ways that were not originally envisioned.

There is no one method for conducting Technology Assessment. The nature of the technology to be assessed strongly influences the method to be used. There are, however, some basic criteria which a genuine, effective, meaningful Technology Assessment must meet. If it is to serve as a warning signal and as visions of opportunity, as an effective device for protecting man from his own technological inventions and as a mechanism for allocating scientific resources, then Technology Assessment must be balanced. It must provide a balanced look at all alternatives, options and possible outcomes. It must be comprehensive, imaginative and broad in scope, taking adequate account of legal, economic, political, social and environmental effects. It must be reliable and credible; objective and neutral.

The Assessment of Technology, in the sense now in vogue, involves two basic steps: determining what the effects of the adoption of a new technology on society will be and attaching some economic and/or moral value to each effect and making a value judgment to decide if the effects are worthwhile. The first step involves gathering information about a proposed technology and the potential impacts it will have on society. Assessment at this stage must seek answers to such questions as how is a technological innovation going to be used now and how will it be used in the future?; what will be the direct, indirect, positive and negative consequences of the uses of the technological innovation?; since modern technology has assumed an interlocking posture, what responses or interactions can be expected from other areas of science and technology?; how do the tonic effects balance out against the toxic effects?; are the effects irreversible in the short-run or long-run?; what options are there?; could the benefits of a new technology be achieved at less costs or less risk by some alternative?; can the technology be used for something else beneficial to society?

Technology Assessment must seek information that relates not only to the present but also, and perhaps more importantly, to the future. It must forecast future trends both to uncover potential problems that otherwise would not be foreseen and to disclose unappreciated opportunities. It must suggest where emerging technological developments are likely to lead.

Forecasting future trends and effects presents a problem and especially so when it is done with low levels of understanding and control in highly complex and changing systems. There are a number of ways forecasting may be done. It may be done by intuition, i.e. using intuitive methods to assess some aspect of the future. This method depends on the inspiration and imagination of the forecaster. Thus an individual with sharpened insight draws on his experiences and imagination to state what he thinks may occur, in a George Orwellian fashion. Forecasts of potential effects of new developments may also be made by assuming that trends established in recent history will continue. The method assumes that the forces at work to shape the trend in the past will continue to work in the future. Other techniques developed to forecast technological change include "future-history" or scenario writing and preparing decision trees. Scenario writing is a method which uses a narrative description of a potential course of development which might lead to a state of affairs. A decision tree is a graphic device which displays the potential results of alternative approaches. The problem here is that by and large these techniques produce results the reliability of which have not been tested. They are limited in their scientific basis. For example, the method of forecasting the future on the basis of past and present trends, while it may be useful for surprise-free projections, will entirely miss discontinuities in technological developments such as those caused by the introduction of the transistor. In extrapolating from the past to the future there is no firm basis to assume that the future will resemble the present or the past. And no path is actually as clear as the decision tree method implies. Actually, consequences may occur over a very complex series of stages.

One of the biggest problems of Technology Assessment relates to the question of who does the assessment: Who must provide the information about a proposed technology and its potential societal impacts? Who must decide to reject, modify or adopt a proposed technology? There is no consensus on who should assess technology. Paul Goodman (1969) assigns the responsibility to the technologist. "...Thus it is up to the technologists, not to regulatory agencies of the government, to provide for safety and to think about remote effects" Goodman (1969:62) writes. Joseph Coates (1976) argues that much of the responsibility of making assessments and putting them to use in controlling technological progress

must rest with government. The function of government, after all, is to set ground rules and establish priorities within which private groups may operate. Henry Skolimowski (1976) takes the position that no system can adequately assess itself. Technology Assessment is not an insignificant evaluation of some aspects of technology. "Technology Assessment is a social critique of Technology at large. This critique may be vital to the survival of the technological society, or should we say, may be vital for the preservation of society and its evolution towards a post technological society. Therefore, this critique must not be left in the hands of those who are often themselves responsible for creating powerful but sometimes lethal tools. We must therefore be aware that Technology Assessment does not degenerate into a servile adjunct of Technology" (Skolimowski: 1976:422).

I tend to believe, like Skolimowski, that no system can adequately and meaningfully assess itself. Assessment done by the innovators and promoters of a technology is less likely to meet the criteria of reliability, objectivity and neutrality. Technologies are not socially neutral in impact. Each technological package carries with it benefits to some, deficits/costs to others. A new technology quite often is designed and introduced to solve somebody's problem and it has somebody's values built into it. Any technological package thus reflects the choices, priorities and problems of some individual or group. In the early stages of development and promotion the only people who are likely to have a grasp of the technology are those who have developed it and who promote it to solve some problem with which they are concerned. Such innovators and promoters are concerned with designing for first order effects such as technical, economic, legal and political feasibility. But first order technological solutions generate an extended chain of effects of secondary, tertiary and higher orders which may cumulatively outweigh primary effects in physical, biological and social worlds. Technological promoters, seeing an opportunity to solve a problem to their advantage are often ignorant of the risks, blinded by enthusiasm, or loath to point out any foreseen difficulties for fear that opponent groups will seize on a perceived negative consequence to block project advancement. Technology Assessment is too important a social tool to be left in the hands of technocrats and their predominantly technical criteria. And opponents of a proposed technology are likely to be equally partial and biased. They are likely to stress and magnify the negative impacts of the technology while ignoring and playing down whatever positive effects it may have on society. Who then must assess?

A genuine Technology Assessment demands expertise and intellectual discipline. It requires an interdisciplinary, multidisciplinary approach. It requires team effort -- a team including a wide range of talents across a full spectrum of scientific and sociological disciplines and independent from the preconceptions and interests, real or imagined, of the innovator, spon-

sor or promoter of the technology to be assessed. Interdisciplinary research is a difficult task but since technology assessment is intended to provide a holistic picture of technological change, extensive interaction among a range of professionals is necessary. One might expect to find, for example, environmental specialists, lawyers, humanists, engineers, economists, systems analysts, social scientists and representatives of interest groups on an assessment team (Porter et.al. 1980). The particular mix of professionals on any team of course will depend upon the type and nature of the technology to be assessed.

The second step (in assessment) involves making decisions to adopt, modify or reject a proposed technology. By what criteria must these decisions be made? These decisions must be made against some priorities, values, goals or standards. "All genuine assessment" writes Henry K. Skolimowski, (1976:422) "must terminate in value terms. Genuine Assessments must be moral, human and social assessments related to some intrinsic values in which ultimate ends of man's life are expressed." The question is, against whose values, priorities, goals, standards must the decisions be made. If assessment is to do what it is intended to do, the decisions must be made against **societal** goals/values; against, that is, some well established societal or national goals/values of priorities that can be well defined and widely agreed upon. In a pluralistic democratic society such as this, establishment of societal/national goals and priorities can be problematic. The important question here again is who sets or is to set the goals and priorities. The on-going debate on the U.S. national decision-making process between C. Wright Mills and the Elitist School of thought and David Riesman and the Pluralist School of thought comes to mind.

The transferability of modern technology creates a different type of problem relating to values and goals. The developed West has not only shaped modern technology but has also aggressively exported it to other societies most of whom recieve it avidly. Must the receiving societies do their own assessment against their own societal goals/values and priorities before adopting the imported technologies? This would seem to be the logical thing to do, but unfortunately most socieities cannot wait. For some it is necessary to discount the future in favor of survivial, and imported technologies have been utilized with very unpleasant consequences.

In the U.S., the National Environmental Policy Act of 1969 (Public Law 91-109) has enormously stimulated technology assessment. The EPA requries every U.S. government agency planning a project to file with the Council for Environmental Quality an assessment of the impact of the project on the environment. Though the EPA requires each assessment report to specify "current and foreseeable trends in the quality, manage-

ment and utilization of such environments and the effects of those trends on the **social, economic and other requirements of the nation**", most of the "assessments" being done emphasize the environmental impacts more than the social, economic and other impacts of the technologies they assess. They are more concerned with pollution control and other environmental matters. They are fraudulent from a social and human point of view, for while paying lip service to social aspects, the overall tenor and methodology and conclusions are technical -- a technical exercise performed by technicians, many times the same technicians who developed the technology that is assessed. While an evaluation of the role of technology on the degradation of the environment is an essential part of any overall assessment, it is wrong to view technology assessment as just another means of controlling pollution, to concentrate on environmental impacts alone and to overlook other by-products of a technology which could be more hazardous and undesirable. Technology Assessment demands a more comprehensive approach.

One would expect that given the potential dangers that modern technology poses to society, the idea of Technology Assessment would be universally hailed. But not everyone believes that Technology can or should be assessed. There is concern and fear among some that Technology Assessment may put too much stress, or greater stress, on negative impacts and may consequently become "technology harassment", or even "technology arrestment". The fear here is that Technology Assessment may be used as an excuse for a general assault on science and technology; that it may discourage investment and undercut innovation; that by adding new costs and delays in an increasingly competitive world, assessment could well weaken U.S. ability to meet challenges from overseas; that assessment will limit freedom of choice. These fears are not unreasonable. The fact, though, is that a well-designed, genuine Technology Assessment must be balanced. It must identify all potential impacts -- the risks and negative aspects as well as the benefits and positive aspects of technology. If assessment is done even handedly it should "promote the use of unappreciated and unemployed technology so that on balance it will enhance our well being and reduce the long-term cost of innovation. It should help to stem the waste that results from poorly planned, unproductive, and infeasible programs of research and development. At the same time it should spur the development of beneficial technologies that might otherwise be overlooked because they seem to fall too far outside the market place economy to warrant exploration" (Kiefer, 1971). The purpose of a genuine Technology Assessment is not to sap the creative vision or freedom of innovators, but to enlarge the domain of choice. If a man chooses among alternatives unaware of the consequences, is he really free?

CONCLUSION

The paper has pointed to some problem areas in the assessment of technology and the inadequacies of what is posing as Technology Assessment in the U.S. The purpose is not to downplay the significance and importance of Technology Assessment. A genuine Technology Assessment is a must, because the concerns out of which the idea emerged are real. Technologies must be assessed before unwanted, unanticipated, and damaging consequences are allowed to inflict intolerable amounts of harm on mankind and the environment. Technologies must be assessed so we can make better, more efficient use of our technological developments. Prudent Technological choices must be made. But such choices -- and this is the point of emphasis of the paper -- must not be made in a haphazard, cavalier, slipshod, profit centered, disorganized manner. We must find more effective, rational, practical methods of establishing priorities, of identifying and weighing the trade offs in the decisions that we make, and of recognizing how a decision made today in this society may irreversibly affect the decisions we and others elsewhere may want to make tomorrow. Assessment may slow technological progress but the results would be lasting.

REFERENCES

M. S. Baran (1973). "Technology Assessment and Social Control", **Science,** May 4, pp. 465-473.

J. F. Coates (1971). "Technology Assessment: The benefits, the costs, the consequences", **The Futurist,** 5, pp. 225-231.

----- (1976). "Technology Assessment - A Tool Kit", **Chemtec,** June, p. 372.

Peter F. Drucker (1973). "New Technology: Predicting its Impact", **Tasks, Responsibilities, Practices,** Harper and Row, pp. 330-332.

Paul Goodman (1969). **New Reformation: Notes of a Neolithic Conservative,** Random House.

Theodore J. Gordon and Robert H. Ament (1969), "Forecasts of Some Technological and Scientific Development and their Societal Conse-quences", Institute for the Future, Report R-6, Middletown, Conn., September.

M. V. Jones (1972). "The Methodology of Technology Assessment", **The Futurist,** 5, pp. 234-239.

C. Wright Mills (1956). **The Poer Elite,** Oxford University Press, New York.

Alan L. Porter, et.al. (1980). **A Guidebook for Technology Assessment and Impact Analysis,** Elsevier Science Publishing Company.

David Riesman (1953). **The Lonely Crowd,** Doubleday Anchor Edition.

Henryk Skolimoski (1976). "Technology Assessment in a Sharp Social Focus", **Technological Forecasting and Social Change,** 8, pp. 421-425.

Alvin Toffler (1972). **The Futurists,** Random House.

Jerome Weisner (1973). Quoted in A. H. Cahn and J. Primack, "Technologi-cal Foresight for Congress", **Technology Review,** March/April, pp. 39-48.

KNOWLEDGE OF ALCOHOL AND ALCOHOL CONSUMPTION BY COLLEGE AND UNIVERSITY STUDENTS

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ABSTRACT

Data were collected from 570 college and university students regarding their knowledge of alcohol and alcohol consumption. The respondents were stratified into three groups--frequent drinkers, infrequent drinkers and abstainers. Data were analyzed with chi-square tests. No significant relationships were found between alcohol consumption and knowledge of alcohol for male students. Significant relationships were found for females, indicating that high knowledge of alcohol was related to frequent consumption of alcohol in females.

INTRODUCTION

There is little disagreement that alcohol consumption by college and university students is a critical campus problem. In fact, many campus administrators feel that alcohol is more of a problem and presents more danger than other drugs (Hirschorn, 1987). In surveys conducted in 1974 and reported by the National Institute on Alcohol Abuse and Alcoholism (1976), from 71 to 96 percent of college students reported drinking alcohol at least occasionally. At most institutions the range was from 87 to 93 percent. About one-third of college students had had drinking problems during the previous year.

More recently, The Department of Health and Human Services (Johnston et al., 1986) reported that 92 percent of college students had consumed alcohol in the previous twelve months, 80 percent had consumed alcohol in the previous month and 45 percent had consumed five or more drinks in a row in the past two weeks. In a 1986 study of 600 university students, it was found that 95 percent had used alcohol, 87 percent had used it during the last twelve months and 76 percent had consumed it during the last 30 days (Brigman and Knox, 1987). Perhaps even more disturbing are findings that students of both sexes increased their alcohol consumption after arriving at college (Berkowitz and Perkins, 1985; Friend and Koushki, 1984).

The prevention of alcohol abuse and the effects of alcohol on the user and others are, of course, major issues for health educators and health service personnel. Alcohol education has historically dealt primarily with cognitive material, with particular attention given to the negative effects of alcohol. Many programs still embrace this approach as their main thrust. Kinney and Peltier (1986) described the common elements of campus programs as consisting of alcohol awareness weeks/days, educational outreach programs to living groups (fraternities, sororities and dormitories) and sponsorship of residency hall advisor training. Savage (1984) characterized alcohol education programs as consisting of four types. The first is a biological emphasis that acquaints the students with the properties of alcohol and how it functions in the body. The second type emphasizes alcoholism. The third is an "evils of alcohol" approach with an attendant pattern of moralizing and preaching. The fourth approach involves a "resource blitz," featuring a procession of resource people and material. With the exception of the third, all approaches are largely implemented from a perspective of abstinence based upon facts regarding the harmful effects of alcohol.

Factual information has not, in general, proven to be deterrent to alcohol use or abuse (Ungerleider and Bowen, 1971). Indeed, a number of researchers (Mason, 1972; Stuart, 1974; Swisher and Hoffman, 1971; Mascoll, 1976; Adams, 1980) found that programs devoted primarily to knowledge do little to reduce the use of alcohol and in some cases were associated with increased willingness to imbibe.

There is, however, a logical reason for the cognitive approach to alcohol education. Simply put, a person cannot make informed decisions without facts. The hope is that raising awareness and educating students about risks and consequences of alcohol abuse will help them curtail excessive drinking (Claydon and Sloane, 1986). This approach is widespread and ingrained in curricula and outreach programs and, therefore, its effects should be continually monitored.

The purpose of the current study is to contribute to the ongoing evaluation of this approach to alcohol education. Specifically, the purpose of the study is to determine if relationships exist between knowledge of alcohol and alcohol consumption in college students. Since college students have completed the secondary school health education experience which usually includes alcohol education, data regarding their knowledge and drinking behavior also provide a reflection of the results of these curricula.

Methodolgy

Data were collected from 570 college and university students at three institutions of higher education during the 1986-87 academic year. The students were enrolled in health science courses. These courses are generally required for graduation and provide a good cross-section of the student population. Alcohol education had not been provided in the health science courses before collection of the data.

The Alcohol Knowledge Test and the Alcohol Consumption Questionnaire were administered to the participants. The former is a true-false instrument consisting of 35 items. Its validity was previously established by a panel of experts and its reliability was established earlier by the test-retest method (Butler, 1982). The latter instrument is an anonymous self-report questionnaire which yields the respondent's age, sex and alcohol consumption in terms of average number of drinks per week. The average weekly consumption was used to stratify the sample. Anonymous self-report instruments which have as their purpose the discovery of the extent of respondents' drug use have been utilized extensively (Friend and Koushki, 1984; Kniepmann, 1986; Jessor, R.T. and Jessor, S.L., 1975; Krug and

Henry, 1947; Jessor, R.T. et al., 1972; Wechsler and Thum, 1973; Holroyd and Kahn, 1974; Globetti, 1972). The validity and reliability of such instruments have been demonstrated by King (1970), Luetgert and Armstrong (1973), Pretzel et al. (1973) and Mott (1976).

Using Korcok's (1969) definitions, the sample was stratified into drinking categories. An abstainer was one who reported no alcohol consumption during the previous twelve months. An infrequent drinker was one who reported an average of less than two drinks per week. A frequent drinker was one who reported an average of two or more drinks per week.

Data were analyzed using a chi-square test. For purposes of analysis, an alpha of .05 was selected to establish statistical significance. The upper and lower twenty-seventh percentiles were used to indicate high and low knowledge, respectively, because the Educational Testing Service (1960) has designated these as the optimum levels to balance Type I and Type II errors. Results were computed separately for males and females.

Findings

Four hundred, eight of the respondents were female. One hundred, sixty-two of the respondents were male. Overall, 198 (34.7%) of the sample were frequent drinkers, 188 (33.0%) were infrequent drinkers and 184 (32.3%) were abstainers from alcohol. Among the females, 102 (25.0%) were frequent drinkers, 152 (37.3%) were infrequent drinkers and 154 (37.7%) were abstainers from alcohol. Among the males, 96 (59.3%) were frequent drinkers, 36 (22.2%) were infrequent drinkers and 30 (18.5%) were abstainers from alcohol. Table 1 presents these data.

Table 1. SUMMARY OF SAMPLE BY DRINKING CATEGORIES

	Frequent Drinkers	Infrequent Drinkers	Abstainers
All respondents	198	188	184
Females	102	152	154
Males	96	36	30

The chi-square value for females was 10.75. This was significant at a level greater than .005. Examination of the chi-square table (see Table 2) indicated that more frequent drinkers appeared in the high knowledge group than would have been expected and that fewer frequent drinkers appeared in the low knowledge group than would have been expected.

Table 2. CHI-SQUARE TABLE FOR FEMALES

	High Knowledge	Low Knowledge	Total
Frequent Drinker	o = 46 e = 34.84	o = 14 e = 25.16	60
Infrequent Drinker	o = 82 e = 87.10	o = 68 e = 62.90	150
Abstainer	o = 52 e = 58.06	o = 48 e = 41.94	100
Total	180	130	310

Chi-square = 10.75 (significance level -- 0.0046)

df = 2

The chi-square value for males was 1.05, which was not significant at the .05 level. The chi-square table for males is presented in Table 3.

Table 3. CHI-SQUARE TABLE FOR MALES

	High Knowledge	Low Knowledge	Total
Frequent Drinker	o = 40 e = 39.37	o = 26 e = 26.63	66
Infrequent Drinker	o = 18 e = 16.70	o = 10 e = 11.30	28
Abstainer	o = 10 e = 11.93	o = 10 e = 8.07	20
Total	68	46	114

Chi-square = 1.05

df = 2

Discussion

The results of the study do not support the traditional rationale of alcohol education, i.e., increased knowledge relating to alcohol will result in decreased consumption. Knowledge was not found to be a good predictor of less alcohol consumption in either gender group.

The findings regarding females deserve particular attention because of their statistical significance indicating a relationship between alcohol consumption and knowledge. A very critical finding (see Table 2) was that among frequent drinkers, more had high knowledge than would have been expected and fewer had low knowledge than would have been expected. Further, at the opposite extreme, fewer of the abstainers were in the high knowledge group than would have been expected and more were in the low knowledge group than would have been expected. These findings are in direct opposition to the cognitive based approach to alcohol education which implies that a higher degree of knowledge would lead to greater number of abstainers and a lesser number of frequent drinkers.

In the past several years many health educators have begun emphasizing an approach of moderate or "responsible" use of alcohol as opposed to abstinence. The results of this study does not support the conclusion that factual information leads to this end in college students.

In light of these findings, it behooves health educators to consider variables in addition to factual information in our efforts to reduce excessive consumption of alcohol in college students. Although such areas as locus of control, self concept and ability to establish and maintain interpersonal relationships are examples of areas which have been included in some alcohol education programs, they merit more research as they relate to alcohol consumption.

Students need and deserve factual information so that they may make informed decisions. Knowledge about alcohol is basic to responsible decision making (St. Pierre and Miller, 1985). However, information does not appear to be the primary force behind decisions relating to alcohol consumption. On the other hand, it may be part of a complicated network of variables which influence drinking behavior. As Berkowitz and Perkins (1986) asserted, drinking, especially problem drinking needs to be understood in relation to behavioral, motivational, personality and gender-related patterns as occurring within a unique social context of college environments. More research is needed to determine the specific forces which are at work in the decision process. Such variables must be implemented into our health curricula, intervention programming and outreach efforts.

REFERENCES

Adams, V.E. (1980). The effects of a special emphasis class on the perceived self-concept, knowledge of alcohol, academic achievement, and attendance of a selected group of middle school students. **Dissertation Abstracts International, 40,** 5395-5396-A.

Berkowitz, A.D. & Perkins, W.H. (1985). Gender differences in collegiate drinking: Longitudinal trends and developmental patterns. **Paper presented at Annual Meeting of the American College Personnel Association, Boston.**

Berkowitz, A.D. & Perkins, W.H. (1986). Problem drinking among college students: A review of recent research. **Journal of American College Health, 35,** 21-28.

Brigman, S.L. & Knox, R.W. (1987). Drug use study: The use of alcohol, nicotine, over-the-counter, prescription and illicit drugs among college students. Tempe, Arizona: Arizona State University.

Butler, J.T. (1982). Early adolescent alcohol consumption and self-concept, social class and knowledge of alcohol. **Journal of Studies on Alcohol, 43,** 603-607.

Claydon, P.D. & Sloane, D.C. (1986). Alcohol and the college student: A challenge to the college health service. **Journal of American College Health, 34,** 226-227.

Educational Testing Service (1960). **Short cut statistics for teacher made tests.** Princeton N.J.: Educational Testing Service.

Friend, K.E. & Koushki, P.A. (1984). Student substance use; Stability and change across college years. **The International Journal of the Addictions, 19,** 571-575.

Globetti, G. (1972). Problem and non-problem drinking among high school students in abstinence communities. **The International Journal of the Addictions, 7,** 511-523.

Hirschorn, M.W. (1987). Alcohol seen no. 1 campus abuse problem, despite concerns about students' drug use. **Chronicle of Higher Education, 33** (March 25), 32+.

Holroyd, D. & Kahn, M. (1974). Personality factors in student drug use. **Journal of Consulting and Clinical Psychology, 42,** 236-243.

Jessor, R.T., Collins, M.I. & Jessor, S.L. (1972). On becoming a drinker: Social and psycological aspects of an adolescent tradition. **Annals of the New York Academy of Science, 197,** 199-213.

Jessor, R.T. & Jessor, S.L. (1975). Adolescent development and the onset of drinking. **Journal of Studies on Alcohol, 36,** 27-51.

Johnston, L.D., O'Malley, P.M. & Bachman, J.G. (1986). **Drug use among American high school students, college students, and other young adults: National trends through 1985.** Rockville, Maryland: National Institute on Drug Abuse (U.S. Department of Health and Human Services).

King, F.W. (1970). Anonymous versus identifiable questionnaires in drug usage surveys. **American Psychologist, 26,** 982-985.

Kinney, J. Peltier, D. (1986). A model alcohol program for the college health service.
Journal of American College Health, 34, 229-233.

Kniepmann, K. (1986). Gathering and utilizing information about campus drinking (Abstract). **Journal of American College Health, 35,** 58.

Korcok, M. (1969). Another candle to light the darkness--some new facts on adolescent use of mood modifying substances.
Journal of Alcohol Education, 14, 21-24.

Krug, S.E. & Henry, T.J. (1947). Personality, motivation, and adolescent drug use patterns.
Journal of Counseling Psychology, 21, 440-445.

Luetgert, M.J. and Armstrong, A.H. (1973). Methodological issues in drug usage surveys: Anonymity, recency, and frequency.,
The International Journal of the Addictions, 8, 683-689.

Mascoll, S.H. (1976). The effect of alcohol education programs on knowledge, attitudes and intended behavior of eighth grade students. **Dissertation Abstracts International, 37,** 2003-2004-A

Mason, M.L. (1972). Drug education effects: Final report. Washington, D.C.: National Center for Education Research and Development.

Mott, J. (1976). The epidemiology of self-report drug misuse in the United Kingdom. **Bulletin on Narcotics, 28,** 43-54.

National Institute on Alcohol Abuse and Alcoholism (1976).
The whole college catalog about drinking, Rockville, Maryland: U.S. Department of Health, Education and Welfare.

Pretzel, T.P., Johnson, J.E. & McKillip. J. (1973). Response bias in drug survey.
Journal of Consultant and Clinical Psychology, 40, 437-439.

St. Pierre, R. & Miller, D.N. (1985-86). Future directions for school based alcohol education. **Health Education, 16** (7), 11-13.

Savage, T.V. (1984). Investigating the social aspects of alcohol use.
Health Education, 15 (1), 49-50.

Stuart, R.B. (1974). Teaching facts about drugs. Pushing or preventing.
Journal of Educational Psycology, 66, 189-201.

Swisher, J.D. & Hoffman, A.M. (1971). Real research in drug education information: The irrelevant variable. **Paper presented at American Personnel and Guidance Association Convention, Atlantic City, New Jersey.**

Ungerleider, J.T. & Bowen, H.L. (1971). Drug abuse and the schools. In P.F. Healy and J.F. Manak (Eds.), **Drug dependence and abuse resource book** (pp. 205-212). Chicago: National District Attorneys Association.

Wechsler, H. & Thum, D. (1973). Alcohol and drug use among teenagers: A questionaire study. In M.E. Chavetz (Ed.),
Proceedings of the second annual conference of the National Institute on Alcohol Abuse and Alcoholism (pp. 33-46). Rockville, Maryland: National Institute on Alcohol Abuse and Alcoholism.

SOMETHING MORE THAN A CHANGE IN COMPLEXION? WHAT'S THE REAL IMPACT OF INTEGRATING HISTORICALLY BLACK INSTITUTIONS OF HIGHER EDUCATION?

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According to Dr. Kenneth S. Tollett (1982), former director of the Institute of the Study of Educational Policy, "Black colleges, by virtue of their proven record of reversing and overcoming discrimination through the education of disadvantaged blacks, are instruments of affirmative action" (p.xi). Affirmative action instruments, in Dr. Tollett's opinion, are "...positive programs, policies and procedures designed to correct or eliminate past and present discrimination" (p.vii).

Because of their special function in educating blacks by providing creditable models of success, psycho-socially congenial settings, special group-oriented transitional educational enclaves, insurance against a generally declining interest in the education of blacks, political-economic resources for their communities, wider freedom of choice for both black and white students, and the discovery, storing and preservation of the black cultural heritage, predominately black colleges are quintessentially affirmative action institutions. (p.4).

Historically black colleges are institutions that were founded primarily for black Americans, although their charters were, in most instances, not exclusionary. These are institutions serving, or identified with service to, black Americans for at least two decades, with most being 50 to 100 years old. (National Advisory Committee, 1980, p.4)

The list of achievements attributed to historically black colleges and universities is impressive: (a) By 1947, nearly 90% of the college degrees held by blacks were from black colleges; by 1967, this figure was still 80%; (b) In 1975-76, historically black colleges awarded 22,000 bachelor's degrees to blacks, representing 38% of all bachelor degrees conferred on blacks nationwide (National Advisory Committee, 1980).

According to one estimate, 75% of all blacks holding Ph.D. degrees, 75% of all black army officers, 80% of all black federal judges, and 85% of all black doctors came from black institutions of higher learning (Jordon, 1975). Historically black colleges also produced about 68% of all black scientists receiving degrees before 1974 (Allen, 1985).

Fleming (1984) asked, "Is it the case that black institutions contribute something unique to black education that is unlikely to be duplicated by white institutions now or in the near future" (p.3).

Results of an extensive comparative study of black students at predominantly black institutions and predominantly white institutions support the uniqueness of predominantly black institutions in enhancing the academic development of black students. In this study, students were compared on

various academic/intellectual and psychosocial measures, including adjustment of academic life, academic performance, social adjustment, motivation, etc. Fleming stated, "The most consistent finding of this study is precisely the one least expected by critics of black institutions: that black colleges produce greater gains in the cognitive domain" (p. 186-187). Better facilities and the reported superior research faculty always ascribed to predominately white institutions do not seem to translate into a better education, at least not for the majority of black students at predominantly white institutions. "...by the same token, inferior resources do not ensure an intellectual disservice to students" (p. 186).

According to Dr. Tollett, although, "...they (black colleges) presently enroll less than 20% of blacks attending post-secondary education, they still produce nearly 40% of black baccalaureates." It is clearly an understatement to say that predominantly black institutions of higher learning--and particularly historically black colleges and universities--play a significant role in providing blacks an opportunity to achieve social, political and financial gains promised by the American dream.

Research findings suggest that black students have not fared well on predominantly white college campuses (Allen, 1985). Relative to white students, blacks have lower persistence rates, lower academic achievement levels, less likelihood of enrollment in advanced degree programs, poorer overall psychosocial adjustment, and lower post-graduation occupational attainments and earnings.

Recent findings show black students' attrition rates to be five to eight ties higher than those for white students on the same campuses; the "fit" between black student and white colleges has apparently been a poor one (Allen, 1985).

What makes the contributions of black colleges seem so enormous, relative to the problematic black experience on predominantly white campuses, is that the black colleges have produced their gains with students who were, by and large, underprepared; furthermore, black colleges have managed their accomplishments with significantly less financial support and resources than given the predominatley white institutions.

As a result of the tremendous gains attributed to predominantly black colleges and universities, several authors (Jaffee, 1968; LeMelle & LeMelle, 1969; National Advisory Committee on Black Higher Education and Black Colleges and Universities, 1980; Thompson, 1973; Wilson, 1982) have urged that these institutions be preserved, strenghtened and enhanced.

Although black colleges have significantly contributed to the mobility of blacks educationally, socially and politically, Fleming (1984) must ask, "To be or not to be" is, in a nutshell, the question facing the future of some 120 predominantly black colleges and universities in operation today" (p.1). That is the opening sentence in the recently published book entitled, Blacks

in College. Most historically black institutions must ponder the question as to whether they should continue to function as a historically and predominantly black institution, or succumb to the forces which would, in the name of integration and/or desegregation, change its mission as well as its complexion.

Federal desegregation mandates citing black institutions as operating segregated colleges and universities in violation of the Civil Rights Act of 1964 can be seen as an instrumental force which may dictate the future of these institutions (Middleton, 1981, April; 1981, January).

"State governing bodies, under pressure from federal agencies, are increasingly forcing black institutions to become integrated or merge with nearby predominantly white institutions" (Grisby, 1983, p.2). Prior to recent federal desegregation mandates, Ballard (1973) questioned the continued existence of some historically black institutions. If one simply looks at the enrollment trends at historically black colleges and universities across the country, one can understand Ballard's concern--witness West Virginia State University, Bluefield State College in West Virginia, Kentucky State University, and Lincoln University in Missouri--all of which are historically black institutions which are no longer predominantly black. Evidence would seem to suggest that some historically black colleges and universities are undergoing a change in complexion.

Some of the major questions which must be addressed at this point is what effect does this change in complexion have on black students enrolled in these institutions? Will black students fare well academically in these institutions compared to white students? Will these institutions continue to produce proportionately a larger number of black scholars relative to traditionally white institutions?

As part of a recent doctoral dissertation, Grisby interviewed officials of ten historically black institutions. Three of these institutions presently have a majority of white students enrolled.

> The purpose of this study was to examine the means through which historically black public higher educational institutions can simultaneously respond to present federal desegregation mandates and maintain their identities as unique institutions for educating minority students. (p.v).

> The results of the study revealed that historically black public higher educational institutions can respond to federal desegregation mandates and maintain their identities as unique institutions for educating minority students, and that federal desegregation mandates have not significantly affected the mission of these institutions. (p.vi).

Contrary to the view of the majority, officials of once all-black public higher educational institutions that presently had a majority of white students enrolled viewed the increase in white student enrollment as a successful desegregation effort. (p.vii).

While officials at these three historically black institutions which now have a majority of white students enrolled view the increase in white student enrollment as a successful desegregation effort, it behooves one to carefully evaluate black student performance at these institutions. Will black students continue to be as successful in a historically black institution which has become predominantly white remains to be addressed and should be the focus of research efforts in this area particularly given the recent trend toward increasing white student enrollment at historically and predominantly black institutions.

A preliminary comparative analysis of black and white students on variables relative to scholastic achievement at a historically black institution which has witnessed an increased enrollment of white students found cause for concern (Rhodes, 1985). This preliminary analysis indicated black students did not fare well on some scholastic achievement indicators as did white students. Are these data predictive of the future of black students in historically black colleges and universities as their enrollment figures become more and more like white colleges and universities? As more and more white students enroll in historically and predominantly black institutions, systematic evaluations become more critical because the colleges will resemble a predominantly white institution, and overwhelming data have clearly and repeatedly demonstrated that black students, as a whole, have not fared well at predominantly white institutions.

Integration and/or desegregation of historically black colleges and universities may result in much more than a change in complexion. In light of increased pressure to integrate/desegregate historically black colleges and universities, it behooves educators and politicians alike to ponder the current dilemma. What would change really mean for the black community? Historically and predominantly black colleges and universities have a great mission--they must continue to play a significant role in providing blacks the opportunity to achieve social, political and financial gains promised by the American dream.

REFERENCES

Allen, W. (1985). Black student, white campus: Structural, interpersonal, and psychological correlates of success. **Journal of Negro Education, 54**(2), 134-147.

Ballard, A.B. (1973). **The education of black folk.** New York: Harper and Row.

Fleming, J. (1984). **Blacks in colege.** San Francisco, CA: Josey-Bass, Inc.

Grisby, C.D. (1983). **Historically black public higher educational institutions: An analysis of the impact of federal desegregation mandates on institutional identity and mission.** Unpublished doctoral dissertation, University of Cincinnnati.

Jaffe, A.J. (1968). **Negro higher education in the 1960.** New York: Praeger.

Jordan, V.E. (1975). Blacks in higher education: Some reflections. **Daedalus, 104,** 160-165.

LeMelle, T., & LeMelle, W. (1969). **The black college: A strategy for relevancy.** New York: Praeger.

Middleton, L. (1981, April). Five states give U.S. plans on desegregation of colleges. **The Chronical of Higher Education, 22**(7), 13.

Middleton, L. (1981, January). College systems in four states found to have racial imbalances: More fulings expected. **The Chronical of Higher Education, 21**(18), 15.

Rhodes, W.A. (1985, November). **More than a change in complexion: Should historically black institutions of higher education resist integration?** Paper presented at the Faculty Round-Table, Delaware State College, Dover, De.

Thompson, D.C. (1973). **Private black colleges at the crossroads.** Westport CT: Greenwood Press.

Tolletee, K. (1982). **Black colleges as instruments of affirmative action.** Washington, DC: Howard University, Institute for the Study of Educational Policy.

Wilson, D. (1982, June). **Digest of research in social science.** Washington, DC: Howard University, Institute for the Study of Educational Policy.

IDENTIFYING MEDIATING FACTORS OF MORAL REASONING IN SCIENCE EDUCATION

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ABSTRACT

The purpose of this research was to examine how science content knowledge, moral reasoning ability, attitudes and past experiences mediate the formation of moral judgement on environmental dilemmas. The study was conducted in two phases using environmental science majors and non-science majors of college age. Phase One determined if environmental science majors exhibited higher levels of moral reasoning on non-technical environmental social issues than on general social issues and examined the extent to which possible mediating factors accounted for differences in moral reasoning. Phase Two was qualitative in nature, the purpose of which was to observe and identify trends in conversations between subjects as to **how** certain mediating factors are revealed as people form moral judgements. The framework on which this study was constructed incorporates a progressive eduational position; a position that views science education as being interdisciplinary, and a social means to a social end.

INTRODUCTION

Psychosurgery, genetic control, abortion, involuntary commitment, active and passive euthanasia, experimentation with fetuses, prisoners, children and institutionalized persons and the use of limited medical and environmental resources represent only a few samples from a vast population of ethical issues in science. If science educators are going to help students become scientifically literate citizens who are capable of responding to these issues, there must be a concerted effort to explore the factors which facilitate moral reasoning in science oriented areas. In most classrooms, science is largely taught independently of associated ethical or moral issues. To what extent does this content-focused approach enhance moral reasoning in science-related issues? Perhaps students should be given training in moral reasoning strategies independent of science content. Perhaps content knowledge and reasoning strategies require the catalyst of proper attitudes and past experiences before interaction occurs in the formation of moral judgments. The purpose of this research was to explore how science content knowledge, moral reasoning ability, and attitudes relate to the formation of moral judgments in the area of environmental social issues.

Kohlberg (1973, 1976) has expanded and elaborated Piaget's (1948) stage theory of moral judgment. In doing so Kohlberg has held a structuralist position on which the assertion of universal moral stages is made. The position differs from behavioral and psychoanalytic theories in which moral reasoning depends upon knowledge of content and the acquisition of cultural and social experiences (e.g., Skinner, 1971; Bettleheim, 1970; Neill, 1960; Freud, 1937). According to Kohlberg (1976, 1978), a person's forma-tion of a moral judgment is largely determined by the stage of moral development acquired by the individual. While Piaget (1972) agrees that a prime factor in intellectual reasoning is the individual's stage of development, he has noted that individuals tend to reason at more sophisticated levels in areas in which they have more knowledge, interests, and experience. Preliminary observations by Iozzi (1976, 1978) are in agreement with those of Piaget and suggest that people use higher levels of moral reasoning in dealing with environmental issues about which they are knowledgeable.

Rest (1974, 1976, 1979; Rest, et al., 1974) has suggested that moral judgment is not simply a value neutral intellectualizing skill with purely knowledge and logical components, but one that is also related to value commitments. People, for example, may be motivated to reason at higher levels of moral reasoning because they attach great value to the issue or have a positive attitude toward the associated knowledge area. They may also reason at higher levels because they have already reasoned about specific issues by virtue of their interests and attitudes toward the issue and the knowledge area. The probability, therefore, that a person will use a particular level of moral reasoning in the formation of a moral judgment may depend not only on the individual's stage of moral reasoning but also on his or her attitudes toward the content embedded in the issue, the perceived value of the issue, experience in dealing with the issue or related issues, and his or her knowledge of content related to the issue.

PURPOSE

Since Piaget (1972) and Iozzi (1976) have theorized that individuals tend to reason at more sophisticated levels in areas in which they have more knowledge, interest, and experience, the first objective of this study was to determine if environmental science majors exhibit higher levels of moral reasoning on non-technical environmental social issues than on general social issues and if they also reason at higher moral levels on environmental problems than non-science majors. A second objective of the study was to examine the extent to which possible mediating factors (environmental attitudes, knowledge and personal experience) account for the differences in moral reasoning. Since variables associated with moral reasoning do not necessarily mediate it, the third objective was to examine **how**, in addition to what extent, such factors are revealed as people form moral judgments. For example, if knowledge of environmental concepts and past personal experiences are related to differences in moral judgment on environmental issues, it would then be appropriate to examine how that knowledge and experience are used in arriving at a moral decision. In doing that, this study determined, in part, the mediation effect that specific content knowledge and past personal experience have on moral reasoning.

DESIGN AND METHODOLOGY

Subjects

Subjects were from two distinct groups. Third and fourth year environmental science majors from the State University of New York at Syracuse, School of Forestry, comprised one group of 86 subjects. The mean age of this group was 21.7 years; 23 were females and 63 were males. First through fourth year non-science majors (less than twelve credit hours of science) from Syracuse University comprised the second group of 105 subjects. The mean age for the second group was 19.3; 66 were females and 39 were males.

The groups differed with respect to proportion of males and females. It is believed, however, that this sex difference did not influence the results, since 20 studies (Rest, 1979) have shown no sex differences in moral judgment.

Phase One

Phase One involved a multiple post test only design with predicted higher order interactions (Cook and Campbell, 1979). The four instruments used in Phase One of this study are described as follows:

1) The Defining Issues Test (DIT) is a measure of moral reasoning on general social problems. The test consists of stories which present social dilemmas. Each dilemma is accompanied by issue statements which reflect different levels of moral judgment. The subjects rank these statements according to perceived importance. The test is considered to be objective and consistent with Kohlberg's stage theory of moral development (Rest, 1976, 1979). Rest reports highly significant criterion group validity with 50% of the variance in test scores attributed to group differentiation. He also found significant ($p \leq .0001$) longitudinal change validity in both cohort and time-sequential designs. Davidson and Robbins (1978) report test-retest reliability of .80 and Cronback's alpha (internal consistency) index in the upper .70's.

2) The Environmental Issues Test (EIT) is a measure of moral reasoning on specific environmental issues which do not require specialized technical knowledge (Iozzi, 1978). The test format is the same as the DIT. The issue statements are virtually identical; only the content of the dilemmas differs from those of the DIT. Iozzi reports criterion group validity to be significant ($p \leq .001$) across various ages and found convergent validity to be .73 with the DIT. Test-retest reliability of the EIT on college students was determined by Zeidler (1982) to be .79 ($p \leq .001$).

3) Test of Ecology Comprehension (TEC) is a measure of interrelated environmental concepts (Moore, 1971; Hart, 1978). Both Hart and Moore report to have established content validity by consensus among expert ecologists and science educators. Test-retest realiability was found by Hart to be .67 using the K-R formula 20.

4) Ecology Attitudes Inventory (EAI) is measure of environmental attitudes, including verbal commitment, actual commitment, and affect (Maloney and Ward, 1973). Maloney and Ward (1973) report the significance of criterion group validity on the various subscales to range between p .01 and $p \leq .05$. Using Cronback's alpha, reliabilities of .85, .81, and .89 have been found for the subscales affect, verbal commitment, and actual committment on this instrument. Zeidler (1982) found test-retest reliabilities of .85, .86, and .88 for the same subscales, and .92 for the composite score of all these subscales ($p \leq .001$).

Half the subjects from each group were randomly chosen to respond to the EIT first and half were randomly chosen to respond to the DIT first. All subjects responded to the EAI during the first test date. Approximately one week later, the subjects who had taken the DIT the first time responded to the EIT and vice-versa. All subjects responded to the TEC during the second test date.

A 2 x 2 repeated measures ANOVA was performed to examine group (environmental science vs. non-science) differences in moral reasoning applied to different contexts (social and environmental). The purpose of the ANOVA was to determine if individuals exhibit higher levels of moral reasoning in areas in which they have more knowledge, interest, and experience. The ANOVA tested the null forms for the following research hypotheses: H_1 -- There will exist a significant group main effect favoring environmental science majors; H_2 -- There will exist a significant group by moral reasoning context interaction effect; and H_3 -- There will exist a significant moral reasoning context main effect showing a higher mean for the EIT. Multiple regression (both stepwise and hierarchical) analyses were then performed to determine to what extent the following mediating factors accounted for differences in moral reasoning on environmental issues (EIT): moral reasoning on general social issues (DIT), ecology comprehension (TEC), overall environmental attitude (EAI), verbal commitment, actual commitment, and affect. Environmental attitude was a composite score of the latter three variables listed above.

Phase Two

Phase Two was a qualitative study, the purpose of which was to observe and identify mediating factors in conversation as people formed moral judgments. The data from Phase One were factor analyzed. From this analysis standardized factor scores were generated for each individual. A

scattergram showing individuals' performance on the attitude and moral reasoning factors was used to select eleven pairs of subjects. To stimulate conversation and hence reasoning, each pair selected from the scattergram had similar attitudes toward the environment but different levels of moral reasoning. Paired subjects were asked to work together (having their original responses to the EIT on hand) and decide which of their responses would ultimately be placed on **one** final questionnaire which would represent both their opinions on the EIT as one. Conversations between pairs of subjects were tape-recorded and transcribed.

RESULTS

Phase One: Moral Reasoning of Science and Non-Science Students

The results of the 2 x 2 repeated measures ANOVA for unbalanced data (Halpern, 1979) showed that EIT scores were significantly higher than DIT scores (moral reasoning context main effect $F_{(1,189)} = 3.64$, $p \leq .001$) and that there existed significant group by moral reasoning context interaction effect ($F_{(1,189)} = 4.32$, $p \leq .05$).
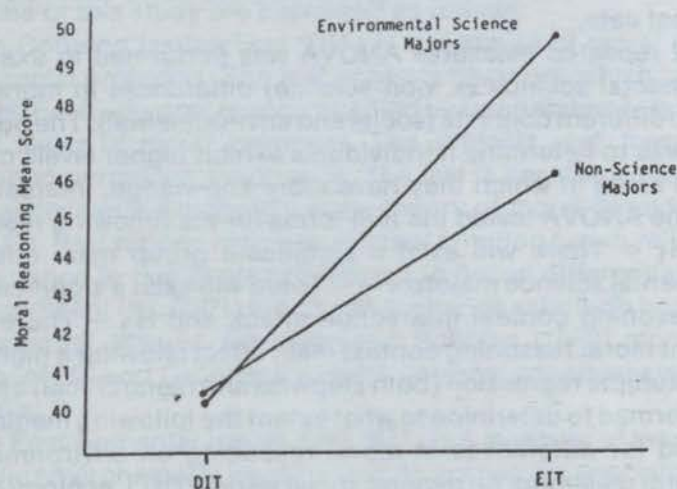
The means for the cells were further analyzed by t-tests to identify the source of interaction displayed in Figure 1. The subjects were randomly purged to obtain equal sample sizes for the groups. The one tailed t-test showed that environmental science majors scored significantly higher ($t(170) = 1.84$, $p \leq .05$) than non-sciene majors on the EIT but not the DIT. The fact that **no** difference existed between groups on the DIT indicated The fact that the age difference between groups was not critical in terms of their moral judgment levels. The within group differences between DIT and EIT scores suggested by Figure 1 were analyzed by means of a correlated t-test

for each group. Significant differences were found for both environmental science majors ($t(85) = 7.488$, $p \leq .001$) and non-science majors ($t(104) = 5.01$, $p \leq .001$) between the EIT and DIT. Both groups scored higher on the EIT than on the DIT. Further t-tests between group scores on the independent variables were examined. To control accumulative alpha at .10, each individual test was set at $p=.02$ (170). No difference existed between groups on Affect. Differences were found to exist between environmental science majors and non-science majors on Environmental Attitude ($t(170) = 7.27$), and Ecology Comprehension ($t(170) = 2.11$), with environmental science majors having a higher mean score in each case.

Finally, it was hypothesized that environmental science majors, having higher levels of environmental comprehension, attitudes, verbal and actual commitment, might subsequently have become more personally invested in thinking out environmental-moral issues. As a result, they may be more willing to decide on a particular course of action in resolving an environmental problem than in resolving a more general social issue. Even non-science majors who perhaps share similar knowledge and personal commitment to the environment may respond more decisively to environmental problems. Therefore, the number of times an individual made a decision on the EIT (checked a "yes" or "no" rather than "can't decide") for a particular course of action on each of the five dilemmas was recorded. This variable was subsequently named "decision commitment". A repeated measures ANOVA of these data reveleaed a significant main effect for moral reasoning context ($F(1,189) = 13.84$, $p \leq .001$). That result revealed that both groups made significantly more decisive commitments on environmental issues (EIT) than on general social issues (DIT).

Phone One: Prediction of Moral Reasoning on Environmental Issues

Research has suggested that moral reasoning is not simply a value-neutral intellectualizing skill embedded within purely cognitive components, but one that is also related to value commitments (Rest, 1974). Thus, one of the aims of this study was to determine to what extent attitudes and knowledge toward the environment are associated with moral reasoning on environmental issues. A preliminary stepwise multiple regressing analysis of the original predictor variables showed that moral reasoning on general social issues (DIT), emotional propensity toward the environment (affect), science orientation (group), environmental attitude and ecology comprehension made significant (F obs. full model $(5,185) = 24.22$, $p \leq .001$) contributions to the prediction of moral reasoning on environmental issues (EIT). The variables verbal commitment and actual committment did not enter the equation.

Since the order of variables could change with different samples, an analysis of the unique contribution of each independent variable on the EIT was performed using a hierarchical regression method. Table I shows that each independent variable made a unique contribution to the prediction of EIT scores even when all the other variables were in the equation.

TABLE I
Analysis of Variables' Unique Contribution to the
Prediction of Moral Reasoning on Environmental Issues Test

Predictor Variable	Increase in R^2	F_{OBS}	DF	Beta
DIT	.31	94.09***	(5,185)	.59
Affect	.03	9.45***		.28
Group (Sci = 1, NS = 2)	.02	6.00***		-.16
Env. Att.	.01	3.67***		-.19
Ecology Comp.	.01	2.75*		.10
VAR 1				
(Group x Ecol. Comp.)	.01	3.82**	(6,185)	-0.42

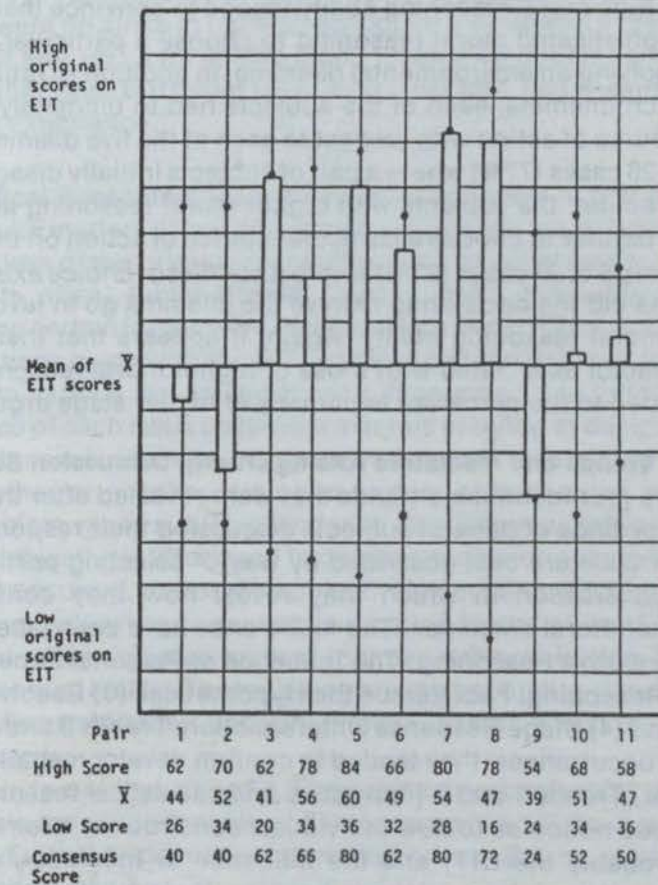$*p = 0.05.$
$**p = 0.01.$
$***p = 0.001.$

In as much as the first ANOVA (Fig. 1) revealed a significant group by moral reasoning context interaction effect, interaction terms from the original predictor variables were created and their unique contributions to EIT score were also examined. Only Group x Ecology Comprehension interaction uniquely contributed to the prediction of EIT score beyond the five single predictors (see VAR 1, Table I). The five single predictors and the interaction term accounted for 44% of the variance (p .001) of the EIT.

Phase Two: Shifts in Moral Judgment During Discussion of EIT Issues
This phase of the study was performed to observe and identify mediating factors in conversation as people form moral judgements. Factor analysis was employed as a descriptive method (Rummel, 1967, 1970) of matching individuals on the basis of similar and dissimilar profile values. Scattergrams (scatterplots) were constructed using standardized factor scores per individual case. The two factors that were most discriminating were used to match subjects. One factor loaded highly on environmental attitudes (.73) and the other factor loaded highly (.77) on measures of moral reasoning (DIT and EIT). The factor scores of individuals were used to form eleven pairs; members of each pair had similar environmental attitudes but different levels of moral reasoning.

The task of each pair of subjects was to discuss their individual responses to the EIT and then decide which responses would finally be placed on one EIT questionnairs. The EIT score from each pair's test was plotted and contrasted with each person's original score on the EIT.

Figure 2 illustrates those results graphically for the eleven pairs of subjects. The original high and low EIT scores of each pair are shown by the points, and the pair's combined score is represented by the bar. The bar extends from the mean of the pair's original EIT scores to the value of the combined EIT.

Pair	1	2	3	4	5	6	7	8	9	10	11
High Score	62	70	62	78	84	66	80	78	54	68	58
X̄	44	52	41	56	60	49	54	47	39	51	47
Low Score	26	34	20	34	36	32	28	16	24	34	36
Consensus Score	40	40	62	66	80	62	80	72	24	52	50

The graph suggests that individuals with high moral reasoning ability generally convince others with lower moral reasoning ability to decide on the responses that relect upper stage usage. The inference drawn is that the issues which reflect higher stage responses are understood by the subjects to be more adequate and encompassing in terms of the resolution of the dilemma; hence the consensus EIT generally reflected higher stage issues than lower stage responses. The exceptions to this trend were pairs 1, 2 and 9. It should be noted, however, that the spread of scores for those cases is generally not as large as the cases in which the consensus score on the EIT approached the upper scores of a pair of subjects.

Another interesting finding of the consensus EIT analysis was that individuals with high moral reasoning ability tended to convince their partners with less sophisticated moral reasoning to choose a particular course of action in resolving an environmental dilemma. In addition to rating various issues of each dilemma, each of the subjects had to ultimately choose a particular course of action with respect to each of the five dilemmas on the EIT. In 20 of 26 cases (77%) where a pair of subjects initially disagreed as to a course of action, the subjects with higher moral reasoning ability convinced their partner to choose a particular course of action on the consensus EIT. In only 6 of 26 cases (23%) where a conflict of choice existed on the EIT dilemmas did the decision to resolve the dilemma go in favor of those with lower moral reasoning ability. Again, it appears that there exists a persuasion factor associated with those of higher moral reasoning ability which is related to the perceived legitimacy of higher stage arguments.

Phase Two: Trends and Mediators Arising During Discussion Sessions

There were four identifiable trends that were revealed after transcribing the tape recordings of pairs of subjects discussing their responses to the EIT. Those trends are best described by way of selecting portions of the subjects' conversation in which they reveal how they construed the environmental-moral dilemmas. The four trends have been labeled as follows: (1) Normative Reasoning: The Influence of Personal Experience; (2) Casuistical Reasoning: Fact Versus the Hypothetical; (3) Resolving Means and Ends; and (4) Stage Response Differentiation. Trends 3 and 4 were not unexpected occurrences; they tended to confirm developmental stage theory. However, Trends 1 and 2 (normative and casuistical reasoning) presented a unique notion as to how individuals construe the dilemmas of the EIT (and probably the DIT) and the influence or mediation effect that educational and social experiences have on their moral judgments. All transcripts were based on ten pairs of subjects rather than eleven, inasmuch as one tape was defective during the recording process.

Normative Reasoning. As the subjects attempted to reach consensus responses on the EIT, they would frequently refer back to previous personal experiences and use those experiences to argue their point of view. Alston (1971) refers to such regularities in the way people respond to situations as habit; Mischel (1973, 1976) suggests that such patterns are a result of one's subjective values. The central point is that experiences (such as social interactions with peer groups, parents, areas of personal interest) with various social norms appear to mediate one's moral reasoning. For example, in considering a dilemma involving teacher strikes, one student said:

"The only reason I put I couldn't decide was because kind of the students' point of view...You know, if it's like the end of the year and finals are cancelled they're all gonna have to be set back another year. We went on strike in my high school for a while and it really screwed a lot of kids up...a lot of kids didn't finish their courses and had to stay another year. But that is why I didn't (decide), just because I knew that past experience."

Casuistical Reasoning. Many individuals confused hypothetical considerations with matters of fact when reasoning on the moral issues of the EIT. The premises of the original moral dilemmas as construed by the subjects were, quite often, subtly altered. Consequently, the subjects' decisions concerning certain issues were mediated by a false type of moral reasoning. The directions given with the EIT (and those of the DIT) ask for subjects to respond to various issues about each dilemma and to judge the relative importance of each issue statement in terms of trying to decide on a course of action for each dilemma. However, rather than responding to the issues as to whether or not they are an important consideration in resolving a moral problem, many subjects tended to treat issues as matters of fact. The subjects subjectively attempted to decide whether or not a particular issue statement occurred, rather than objectively deciding whether or not a particular issue was an important consideration in and of itself. That form of casuistical reasoning was present in those subjects having high and low moral reasoning ability. The following are representative selected quotes of subjects discussing their answers to the EIT upon which the above inference is based:

"Yeah, I would say they did. The teachers probably think that the board people **are** unreasonable and uncooperative." "I don't think he cares about whether people are suffering or not. But he cares about what society thinks."

Resolving Means and Ends. Many individuals tended to view various EIT dilemmas in terms of resolving whether or not particular actions (means) justified the intended end results. Some subjects failed to differentiate among various degrees of an action, or an environmental problem. Those that did recognize that there exist varying degrees of actions and environmental problems, usually considered the broader consequence of an issue. The latter group tended to develop some systematic and well-defined arguments. The following statement reflects that trend:

"I don't think she should report him. Look at what he's trying to get people to be aware of...they were killing a great number of fish. That could have an effect on a rural community...I think he could have found better ways to let people know about that than drop all those leaflets - but he was still doing it for a good cause."

Stage Response Differentiation. Although the issue statements on the EIT are similar in terms of syntax and verbal sophistication, the statement still reflect various underlying developmental properties in terms of moral reasoning. Certain statements reflect post-conventional (principled) reasoning while others reflect conventional stages of moral reasoning. Some individuals with higher moral reasoning factor scores tended to view the principled statements as "broader" and "more abstract" than the non-principled statements, while individuals with lower moral reasoning factor scores usually failed to construe the principled statements as being more encompassing than the non-principled statements. An example of this trend is as follows:

"'What values are going to be the basis for governing how people act towards each other'. That almost parallels number six, 'Whether the power company's rights of ownership have to be respected.' That (the former statement) could actually be the broader scope and then you're narrowing it down (the latter statement) to take the specific."

CONCLUSIONS

Phase One

Results from this study support the proposition that moral reasoning is influenced by the context (setting) of a moral dilemma. It would appear, then, that the propensity to use various levels of moral reasoning is in part situationally determined. A departure from past research (Iozzi, 1976) was found in the within-group differences for non-science majors on moral reasoning contexts (DIT vs. EIT). Both science and non-science majors exhibited significantly higher levels of moral reasoning on environmental issues that on general social issues. Hence, the context of a moral problem

did affect the propensity of individuals from **both** groups to apply different levels of moral reasoning. It is quite possible that both groups of subjects are concerned about environmental issues. That fact that there was no difference between groups on Affect, the emotive feelings toward the environment, suggest that the non-science majors may be concerned about environmental issues (whether their reasons are rooted in social norms or a genuine understanding of complex environmental problems) and will, evidently, increase the propensity for higher stage usage. That explanation would be consistent with Piaget's (1972) observation that people tend to apply more sophisticated reasoning in areas in which they have much interest, knowledge, or experience.

It might also be suggested that the reason both groups score lower on the DIT is because the contexts of the issues are perhaps more extreme and controversial than those on the EIT. The possibility exists that individuals confronted by such personally sensitive issues (life/death) that are generally not common in their everyday experience have previously formulated stands on such issues. Consequently, their propensity to apply higher levels of moral reasoning is hindered by their previous beliefs on those particular issues.

Credence to Rest's (1976, 1979) complex model of stage development was demonstrated when individuals scored differently on the EIT and DIT. Such differences may be attributed to an individual having a **range** of stage usage depending on the context of the problem. This probablistic notion of expressing moral judgment along a quantitative continuum still conforms to developmental theory by preserving the qualitative differences of various levels of sophistication and abstraction that may be expressed in moral reasoning.

Another proposition central to this study was that if moral reasoning is not simply a value-free intellectualizing task independent of content or attitudes toward that content, then significant realtionships between moral reasoning and attitudes ought to exist. Indeed, the variable Affect accounted for the most variation in moral reasoning score for the EIT after moral reasoning on general social issues was taken into account. That result confirms what several researchers (Wright, 1971; Alston, 1971) have proposed to be the case; that a person's moral ideology (which would incorporate his or her moral reasoning skills) can be influenced by the affective loading of the content involved with his or her beliefs.

Although the results showed that DIT, Affect, Group Membership and Environmental Attitude appeared to be better predictors of environmentally related moral issues than Ecology Comprehension, it does not necessarily follow that subjects' scientific knowledge of interrelated environmental concepts was not a major contributing factor in their resolution of the EIT dilemmas. On the contrary, if one considers that Ecology Comprehension

was the second highest correlate with the EIT and more highly correlated with the DIT than the remaining independent variables, it is reasonable to assume that the DIT simply subsumed much of the common unexplained variance over Ecology Comprehension, and that one's knowledge of environmental content was indeed a significant contributing factor in the resolution of environmental dilemmas. Furthermore, the fact that the only significant interaction term consisted of Ecology Comprehension by Group adds credence to the notion that Ecology Comprehension does contribute to moral reasoning on environmental problems. In addition, several individuals did refer to scientific analogies in discussing their positions on the EIT. That interaction term mentioned above (VAR 1) understood in the light of the significant difference between groups on Ecology Comprehension means that given the **same** scientific knowledge of interrelated environmental concepts, by virtue of belonging to group one (environmental science major), an individual applies higher levels of moral reasoning on environmental science issues than non-science majors. Again, the implication of these findings is that there exist certain character traits (e.g., habit, moral indignation, the interplay of one's attitudes on the context of the moral problem) as well as one's familiarity with content which would appear to be important factors to consider when examing moral character or moral reasoning skills.

Finally, when it was found that the context of a moral dilemma significantly affected the level of moral reasoning applied to the dilemma, it was hypothesized that the resolution of a dilemma would also be influenced. Individuals having certain attitudes, knowledge, and past experiences with the issues might subsequently have more personal investment in thinking out environmental moral issues. As a result, they might be more willing to decide on a particular course of action in resolving an environmental problem than a more general social issue. Thus, the variable that reflects the ability to choose a particular course of action when resolving each dilemma on the EIT and DIT was named Decision Commitment. It was found that both groups tended to make more decisive commitments on environmental issues than on general social issues. That, too, supports the contention that moral reasoning is aplied differently in various situations; the context of a moral problem does influence an individual's resolution of the problem.

Phase Two

There were two main findings that were observed from plotting the results of the combined EIT scores. According to Figure 4, individuals with high moral reasoning ability generally convinced others with lower moral reasoning ability to accept certain issues in resolving environmental moral dilemmas as being the most important or pertinent ones. The issues that were generally chosen were, in fact, those issues which reflected higher

stage issues. Individuals with high moral reasoning ability also tended to convince those wth less sophisticated moral reasoning ability to choose a particular course of action in resolving an environmental moral dilemma. It appears that those individuals who apply the higher levels of moral reasoning to an environmental moral dilemma are either more willing or better able to commit themselves to defending and maintaining a specific position in the resolution of that dilemma.

These findings add additional support to the sequentiality studies of Turiel (1966) and Rest, Turiel and Kohlberg (1969) in terms of individuals' preference of moral advice that is generally one or two stages above their own level of moral development (or above the level they are presently employing on a particular problem). The fact that individuals with high moral reasoning convinced others of lower moral reasoning ability to choose a particular course of action in resolving a moral dilemma may be interpreted, at least in part, as support for Kohlberg's (1973) claim of the superiority of higher stages of moral development. However, to be consistent with the complex stage model of development (Rest, 1979), this study does not assume that the individuals of low moral reasoning ability are totally devoid of upper stage usage; rather, that they expressed a lesser range of upper stage usage in certain areas, but nevertheless were sensitive to and persuaded by the "superior" moral arguments manifested in the post-conventional stages of reasoning.

Discussion trends of interviews. The four trends that were identified after transcription of the interview tapes were: (1) Normative Reasoning; (2) Casuistical Reasoning; (3) Resolving Means and Ends; and (4) Stage Response Differentiation. Although those trends were discussed in the previous section, the unanticipated findings with respect to the mediation effect of trends 1 and 2 warrant further interpretation.

One primary aim of Phase Two was to explore references to experiences that demonostrated a link between particular experiences and moral reasoning, hence mediating factors of moral thought. Trend 1 (normative reasoning) illustrated how moral reasoning is not simply an intellectualizing skill that may be applied to different situations without being influenced by one's frequency of exposure to specific content, norm referenced values and past experiences. It would appear from the transcripts that individuals internalize their social experiences which produces their **own** objective reality of the world. In 6 out of 10 pairs, the subjects' moral reasoning, regardless of the level of sophistication, was often shaped or mediated by their normative experiences.

The normative experiences expressed by the subjects were ones that gave evidence as being rooted in emotion. Population control, family members who left their jobs to strike, students quitting school to strike, religious convictions (or lack of), experience with the effects of acid rain and factory pollution, membership in an underground newspaper, are

experiences brought to mind through the subjects' discourses and certainly qualify as emotive norms. It is not surprising, then, that the variable Affect was significant in the prediction of moral reasoning score on the EIT. Furthermore, Affect was the only variable in which a significant difference between environmental science majors and non-science majors did **not** exist. Hence, the impact of the socialization experiences one may have been or will be subjected to should be very much a concern of the researcher and educator, both of whom must take into account the mediation effect of such experiences on one's moral reasoning.

A second intention of Phase Two was to better understand exactly how individuals construe moral problems. After transcribing the tapes of the subjects' conversations, a trend was identified which shed light on how the subjects perceived the dilemmas on the EIT. The term "casuistical reasoning" was chosen to describe a pattern that was identified during the interview because many subjects tended to confuse matters of fact with the hypothetical; hence, a type of false reasoning would ensue. Subjects of both high and low moral reasoning ability would at times discuss the dilemmas in this light. A possible explanation of this trend may be offered in a developmental vein. It is quite possible that many subjects at times construe the moral issues in a concrete sense, as a matter of empirical fact in terms of their interpretations as to the events and issues described by the specific dilemma. It may be the case that to rate an issue in and of itself relative to the bearing it has in resolving a moral dilemma requires rather abstract (formal) skills. Although certain individuals may have the ability to solve problems using more sophisticated skills (higher stages of reasoning), they quite often break down the problems to a more manageable level and consequently use less sophisticated operations in their resolution. That would tend to be consistent with developmental theory.

IMPLICATIONS FOR EDUCATION

The efficacy of the implications which this research has for science teaching rests on the assumption that education is a social means to a social end (Dewey, 1930, 1938, 1964). Science teaching is considered more than helping students acquire science knowledge; it is educating them for the difficult task of resolving moral dilemmas regarding science and social policy (Saber, 1979).

The differences observed in this study between the moral reasoning of science and non-science majors give rise to general implications for science teaching. Science majors did not reason at higher levels than non-science majors on a general measure of moral reasoning (DIT) and therefore likely did not possess superior moral reasoning abilities. Science majors, however, did exhibit higher levels of moral reasoning than non-science majors in responding to nontechnical environmental issues (EIT).

Associated with those higher reasoning levels, science majors exhibited more positive attitudes toward the environment and a greater commitment to and comprehension of ecology than did the non-science majors. These results suggest that the reasoning used in resolving science-oriented moral dilemmas depends not only on general reasoning ability but also on attitudes, commitment, and comprehension. Science teachers therefore should endeavor to not only help students acquire a meaningful understanding of subject matter, but should also strive to help them develop positive attitudes, a care and concern for science-oriented social issues, and a commitment to the resolution of actual issues.

Although this research did not explicitly address the problem of how to help students reason more effectively as they resolve science-oriented moral dilemmas, the finds do imply suggestions both for involving students in discussions which perhaps lead to improved moral reasoning and for identifying students' inhibiting and facilitating reasoning patterns. In the first phase of this study students individually and privately responded to moral dilemmas. Later, in the second phase of the study, some of the same students were paired and challenged to develop a single, consensus response to the same issues. The students in each pair had shown similar attitudes and commitment toward the environment but had reasoned at different levels when they individually responded to the issues. Since students who had initially disagreed as to the resolution of dilemmas had to come to an agreement on the resolution of those same dilemmas, the students engaged in lively discussions in which they developed, defended, and critically examined patterns of reasoning. The results of this study showed that as a consequence of such encounters, students with lower initial reasoning levels, in coming to consensus, tended to accept the higher level of reasoning exhibited by their partners. Perhaps, then, if teachers encourage students with different lines of reasoning to develop consensus resolutions of moral dilemmas, the argumentative encounters which ensue might result in the improved reasoning ability of students.

As students in this study engaged in the agrumentative encounters they revealed both inhibiting and facilitating reasoning patterns. Many students tended to alter the conditions of the problems which they faced and in so doing fell prey to casuistical reasoning. By being cognizant of this tendency, teachers can help students become aware of their attempts to redefine the problem and can help them examine whether such a redefinition is productive or nonproductive. Students in this study also revealed normative reasoning patterns as they developed their arguments from personal experiences. Although teachers shoud encourage students to use relevant past experience, they should also encourage students to examine the applicability of such experiences to the dilemma being considered. Teachers might also help students use personal experiences with moral issues as the basis for developing higher order, more generalizable moral principles.

The development of a scientifically literate society which is capable of effectively dealing with science-oriented social and personal issues is a formidable task. This study has only begun to address the complex issues and problems associated with that task. Without continued efforts we will most certainly fail to prepare our children for those very difficult and extremely important decisions which will determine not only their happiness but their survival, as well.

REFERENCES

Alston, W. (1971). Comments on Kohlberg's 'From is to ought'. In T. Mischel (Ed.), **Cognitive development and epistemology.** New York: Academic Press.

Bettleheim, B. (1970). On moral education. In T. Siger (Ed.), **Moral Education.** Cambridge, Mass.: Harvard University Press.

Cook, T., and Campbell, J. (1979). **Quasi-experimentation: Design and analysis issues for field settings.** Chicago: Rand-McNally.

Davidson, M.L., and Robbins, S. (1978). The reliability and validity of objective indices of moral development. **Applied Psychological Measurement, 2**(3), 391-403.

Dewey, J. (1930). Experience and conduct. In C. Murchiam (Ed.), **Psychologies of 1930.** Worcester: Clark University Press.

Dewey, J. (1963). **Experience and education.** New York: Collier, 1963 (originally written in 1938).

Dewey, J. (1964). Science as subject matter and as method. In D. Archambault (Ed.), **John Dewey on education.** Chicago: The University of Chicago Press.

Halpern, S. (1979). **A multi-step analysis for unbalanced ANOVA.** Paper presented at the Annual Meeting of the American Education Research Association, San Francisco, California, April.

Hart, Earl P. (1978). Examination of BSCS biology and nonbiology students' environmental information level, and environmental attitude. **Journal of Research in Science Teaching, 15**(1), 73-78.

Iozzi, Louis. (1977). Moral judgment, verbal ability, logical reasoning ability, and environmental issues. **Dissertation Abstracts International, 37,** 7662-A. (University Microfilms No. 77-13, 271, 197.)

Iozzi, Louis. (1978). The environmental issues test (EIT): A new assessment instrument for environmental education. In C. Davis and A. Sacks (Eds.), **Current Issues in Environmental Education -- IV.** Columbus, Ohio: ERIC Clearinghouse for Science, Mathematics, and Environmental Education, 200-206.

Kohlberg, L. (1973). The claim to moral adequacy of a higher stage of moral judgment. **The Journal of Philosophy, 70,**18, 630-646.

Kohlberg, L. (1976). Moral stages and moralization: The cognitive-developmental approach. In T. Lockona (Ed.), **Moral develpment and behavior: Theory, research, and social issues.** New York: Holt, Rinehart and Winston.

Kohlberg, et al. (1978). **Assessing moral stages: A manual.** Cambridge: Harvard University, July.

Maloney, M., and Ward, M. (1973). Ecology: Let's hear from the people: An objective scale for the measurement of ecological attitudes and knowledge. **American Psychologist,** July, 583-586.

Moore, J.D. (1971). Defining and interpreting ecology. **Journal of Environmental Education, 3,**(1), 54-57.

Neill, A.S. (1960). **Summerhill.** New York: Hart.

Piaget, J. (1948). **The moral judgment of the child.** Glencoe, Ill.: Free Press, 1948 (originally published, 1932).

Piaget, Jean. (1972). Intellectual evolution from adolescence to adulthood. **Human Development, 15,** 1-12.

Rest, J., Turiel, E., and Kohlberg, L. (1969). Relations between level of moral judgment and preference and comprehension of the moral judgment of others. **Journal of Personality, 37,** 225-252.

Rest, J. (1974). Developmental psychology as a guide to value education: A view of 'Kohlbergian' programs. **Review of Educational Research, 44**(2), 2410259.

Rest, J.R., Cooper, D., Coder, R., Masanz, J., and Anderson, D. (1974). Judging the important issues in moral dilemmas -- An objective test of development. **Developmental Psychology, 10**(4), 491-501.

Rest, J. (1976). New approaches in the assessment of moral judgement. In T. Lickona (Ed.), **Moral development and behavior.** New York: Holt, Rinehart and Winston, 198-220.

Rest, James. (1979). **Development in judging moral issues.** Minneapolis: University of Minnesota Press.

Rummel, R.J. (1967). Understanding factor analysis. **Conflict Resolution, 11**(4), 444-480.

Rummel, R.J. (1970). **Applied factor analysis.** Evanston, Ill.: Northwestern University Press.

Saber, N. (1979). Science, curriculum, and society: Trends in science curriculum **Science Education, 63**(2), 257-268.

Scharf, Peter. (1978). **Readings in moral education.** Minneapolis: Winston Press, Inc.

Skinner, B.F. (1971). **Beyond freedom and dignity.** New York: Alfred A. Knopf.

Turiel, E. (1966). An experimental test of the sequentiality of developmental stages in the child's moral judgments. **Journal of Personality and Social Psychology, 3,** 611-618.

Wright, D. (1971). **The psychology of moral behavior.** Baltimore, Maryland: Penguin Book.

Zeidler, D.L. (1982). **Identifying mediating factors of moral reasoning in science education.** Doctoral Dissertation, Syracuse University, Syracuse, N.Y.