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AUTHOR Zeidler, Dana Lewis
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ABSTRACT

Progressive approaches to science education incorporate a social dimension based on an interdisciplinary curriculum. The importance of such an approach has been recognized by educators and many science-techonology-society (STS) programs have been developed as a response to this social need. However, such programs may fall short of their mark without adequate treatment to the process of moral education for the students engaged in these programs. This paper argues that the process of moral development and policymaking are necessary in the classroom both as a foundation of moral education and as the link which will make otherwise interesting STS programs pedagogically effective ones. This paper explores viable approaches which educators may use in presenting the idea of competing choices with respect to ethical issues in STS and an overview of some of the problems in applying ethical theory to social problems. (Author/CW)

MORAL EDUCATION: THE MISSING LINK TO SCIENCE, TECHNOLOGY AND SOCIETY PROGRAMS

DANA LEWIS ZEIDLER

ASSOCIATE PROFESSOR OF SCIENCE EDUCATION

DELAWARE STATE COLLEGE

DOVER, DELAWARE 19901

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Moral Education: The Missing Link

to Science, Technology and Society Programs

ABSTRACT

Progressive approaches to science education incorporate a social dimension based on an interdisciplinary curriculum. The importance of such an approach has been recognized by educators and many STS programs have been developed as a response to this social need. However, such programs may fall short of their mark without adequate treatment to the process of moral education for the students engaged in these programs. This paper will argue that the process of moral development and policymaking are necessary in the classroom both as a foundation of moral education and as the link which will make otherwise interesting STS programs pedagogically effective ones. This paper will further explore viable approaches which educators may use in presenting the idea of competing choices with respect to ethical issues in science-technology-society and an overview of some of the problems in applying ethical theory to social problems.

Advances in technology have imposed brute facts of reality upon society and many science educators have come to realize that science can no longer be taught in a vacuum, as a discipline with its unique methodologies and content confined within the walls of our classrooms and laboratories. Public consciousness now demands, and rightfully so, that a better understanding of the ramifications of the activity of science is warranted. And science educators now have a prima facia duty to respond to the cry of public awareness by helping to prepare both the non-science major and the science student with the experiences necessary to become informed decision makers with respect to science and social policy (Hurd, 1984). Hence, new approaches to science education (which is not unlike the progressive position of Dewey, 1974, 1963) have been implemented which incorporate a social dimension based on an interdisciplinary curriculum. The progressive position equates subject matter with meaningful experience; it is sound pedagogy that students be exposed to aspects of science through their own familiarity with its social applications. Many Science-Technology-Society (STS) programs have been developed as a response to this social need and arguably represent the most visible concerted effort to develop traditional and new courses in the sciences into a truly interdisciplinary curriculum (NSTA, 1985). A more thorough rationale entailing arguments stressing the need for educational reform and viable approaches for classroom implementation have been published elsewhere (Zeidler, 1984). An important issue, however, remains to be examined. A significant

number of STS programs may fall short of their mark without adequate treatment of the process of moral education for the students engaged in these programs.

Some colleges and universities across the country have developed modularized core courses, separate courses or appendages to traditional science courses that cover a wide range of topics relating science to historical, political, sociological and other societal topics. In fact, one of the main criteria for an STS module is that it permits the learner to "go beyond the specific subject matter to broader considerations of science, technology and society which include a treatment of personal and societal values/ethics" (SSTS, 1985, p. 5). That statement reflects a major goal of most STS programs, but these programs have overlooked an important missing link which would make otherwise interesting programs both pedagogically and developmentally effective ones. It is the premise of the present paper that the process of moral education from a developmental perspective should be incorporated into STS programs particularly at the college level.

STS programs seem to foster problem solving and decision-making skills in their curricula. The curriculum attempts to get students "involved in a societal or personal course of action after weighing the tradeoffs among values and effects drawn from various scenarios or alternative options" (SSTS, 1985, p. 6). Ironically, such policy making does provide a foundation for moral education but this foundation is not further developed and cultivated in most STS programs. In science classrooms that are not

detached for social concerns, policy making plays an important role when discussing moral and ethical issues as it involves deliberation, negotiation and collectively derived decisions. The reason most STS programs fall short of their mark is because they suffer from social or value relativism. Educators who foster this approach either knowingly or unwittingly promote the conception to their students that any given values of a society are appropriate for that society or attempt to have students derive what human values are appropriate for human behavior from factual statements of what is observed to be the case (the naturalistic fallacy). The problem inherent to the relativistic approach in STS programs is that it is either arbitrary at best or indoctrinative at worst.

A possible solution to this problem may be found in the progressive developmental approach of Kohlberg and other (Kohlberg, 1968, 1969, 1972(a), 1973(a), 1976; Kohlberg and Turiel 1972). This approach suggests that philosophical values and social norms with respect to the progressive view of education must also consider the cognitive-developmental facts of the individual. The cognitive-developmental approach to moral education attempts to avoid the arbitrary norms of society and the naturalistic fallacy by coordinating philosophical principles with respect to norms and values with the facts of development. The notion of policy making, then, still is a powerful tool in terms of students resolving some social-science controversy, but in the process students must be stimulated towards higher levels of moral development. Moral education, therefore, includes the conception of fostering development of the individual through

policy-making experiences.

The concept of developmental sequentiality provides a premise on which Kohlberg justifies the superiority of higher stages of moral development. Acknowledging this to be a controversial claim he uses a deontological theory of morality which is formalistic (i.e., impersonality, ideality, universalizability, preemptiveness) while realizing that there exist developmental levels of moral reasoning which increasingly fulfill the formal form of the philosopher (Kohlberg, 1971a). Hence, the claim that the higher stages of moral judgment are better or more moral than the lower stages is to be understood in a formalistic context -- higher stages of moral reasoning <u>better</u> fulfill the criteria of impersonality, universalizability, etc. To Kohlberg, then, the empirically verified notion that individuals prefer the highest stage of reasoning they can comprehend, legitimizes the notion that the higher stages of moral development are more morally adequate or preferable by certain moral criteria (Kohlberg, 1973b). Kohlberg's justification of the desirable moral adequacy of principled reasoning is rooted in a position similar to Rawls (1963, 1971) and Kant (1970). As one progresses through the stages of moral development the criteria for adequate, rational moral judgments are met with increasing adequacy.

The notion of reversibility is a necessary condition in the realm of principled moral thought:

> To say that rights and duties are correlative is to say that one can move from rights to duties and back without change or distortion. Universalizability and consistency are fully attained by the reversibility of prescriptions of actions. Reversibility of moral judgment is what is ultimately meant by the criterion of the fairness of the moral decision (Kohlberg, 1973b, p. 641).

Accordingly, given any party's position in a given situation, the right solution can be reached if reversibility is applied, for each claim could then be considered impartially. A reversible solution, then, is the right solution from any individual's perspective, for any individual involved in the moral decision; it is the ability to reverse a moral perspective.

Universalizability grows out of reversibility; for what is right or fair in a conflict situation is something that all rational beings would choose in that particular situation. Rawls (1971) arrives on similar ground in his conception of fairness (which was derived from Kant, 1970). Rawls maintains that the principles of justice are arrived at from any initial position when they are chosen behind a veil of ignorance of our own or another's position (1963). Applying this principle to solving a moral dilemma on postconventional levels of reasoning one finds that individuals, when faced with competing alternatives, will make a decision knowing the probabilities of outcome of the decision for every person involved, but without necessarily knowing his/her position (who he/she will be) in that situation. It is in this sense that the initial position is fair and from which principles of justice can be agreed upon.

making policy. A fundamental principle that underlies normative ethics and is particularly amenable to issues that affect the sciences and social policy because of the prescriptive value it has is the principle of utility.

The principle of utilitarianism, in general, holds that an action is morally right if it produces at least as great a balance of value over disvalue as an available alternative action (or rule). The nature of the value (which is the utility of central importance) may vary according to one of three common positions: 1) Eudaimonistic utilitarianism (happiness; e.g., John Stuart Mill), 2) Hedonistic utilitarianism (pleasure; e.g., Jeremy Bentham) or 3) Agathistic utilitarianism (good; e.g., G. E. Moore). In any case, the act that is found to maximize value and minimize disvalue is considered the morally correct act to do, and the agents own interests are to be considered equally with those interests that belong to any other individual. Subsequently, a certain sense of impartiality is required in calculating the consequences of any particular act.

Indeed, the difficulty in applying the principles of utilitarianism arise not when a clear choice of action is present but when the choices are many and the consequences vary in degree. Teachers may present this kind of a dilemma to their students by illustrating it with a probability matrix. Those with a background in the biological sciences will quickly recognize this as a Punnet square:

Let X represent one course of action, and Y represent a mutually exclusive alternative course of action. Let the possible

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Let X represent one course of action, and Y represent a mutually exclusive alternative course of action. Let the possible

consequences of either action be represented by theoretical units of value or social good:

1 - all value, no disvalue

2 - mostly value, some disvalue

3 - equal value and disvalue

4 - some value, mostly disvalue

5 - no value, all disvalue

We now can construct the following probability distribution:

Insert Figure 1

As a first step in presenting the notion of competing choices to students in a concrete manner, this technique may help them to come to grips with the situation (dilemma) at hand. Of course, it is clear where action X or action Y are the necessary actions to be chosen by any rational, reflective being. The difficulty arises along the diagonal of the matrix that runs from the upper right to the lower left sides. It would appear that either actions X_1 or Y_1, for example, could be justified as being "morally right" because either choice yields similar degrees of value or disvalue. The same could be said of actions X_2 vs. Y_2, X_4 vs. Y_4, and X_5 vs. Y_5 (the matter of X_3 vs. Y_3 will be discussed later).

As a second step, in an effort to evaluate more precisely the choices that are available to us along the diagonal axis so we may better reach a decision concerning a particular course of action, it would be very useful to students if they could learn

to differentiate between long and short term consequences. Careful assessment of available resources and information, and perhaps some guidance from the teacher would achieve this and further define the dilemma. For example, using the same key from above, but in addition, being able to attach short and long term dimensions to our actions, X will come to represent short term consequences and Y represent long term consequences. Slightly different choices of action are now imposed by the matrix (biology teachers may do well to envision this modification along the lines of X and Y-linked genes):

Insert Figure 2

In this example, decisions are based upon the assumption that the total long term value offsets any long term disvalue, as are in the cases of X_2 vs. Y_2 or X_4 vs. Y_4. Other arguments might be made for other alternatives as well. We might, for example, consider choosing Y_2 over X_1 if we could demonstrate that the long term benefits of value in Y_2 might be offset by any long term disvalue, and that the total good of Y_2 would be greater (in quantity or duration) than that of X_1.

There remains, however, an ethical thorn in the heart of conscience when we are confronted with the center of the matrix. Situations in which actions X_3 vs. Y_3 are not uncommon in society. Consider for a moment, the field of medicine, in which the allocation of scarce medical resources (e.g.: specialized practioners, [illegible]ical and donor organs, transplantation, transfusions, explor-[illegible]esearch) shifts from an economic dimension to an ethical

world. Such dilemmas may include the problems of macroallocation or microallocation, and questions of distributive justice. For example, if a doctor is faced with the decision of how to distribute a limited amount of drug Z to a number of individuals who in total, will require more of the drug than is available, how is the doctor to determine the overall utility of one action over another? Is there not something unsettling in maintaining that either action (X_3 or Y_3) is the good choice, the morally correct action? Quite often, when students are confronted with a situation, they attempt to resolve which competing action to choose by suggesting recourse to some random selection procedure by which the value can be equitably distributed. That may seem fair to some but to suggest which action ought to be performed by flipping a coin when lives are at stake lies in a morally untenable realm.

In the last scenario it is evident that a monistic system such as strict utilitarianism may not always suffice in and of itself. Teachers and students find that at times, utilitarianism fails to arrive at an adequate or complete theory of normative ethics. An alternative approach in evaluating a dilemma from which students may derive policy decisions is one that is rooted in ethical pluralism, and may be found in the work of John Rawls (1971). Rawls appears to blend utilitarianism with deontology, which is another branch of normative ethical theory. Deontology attempts to resolve competing actions by defining the principles or rules upon which an individual acts, rather than net value over disvalue. Rawls' approach is a viable one, particularly

in situations involving questions of distributive justice with respect to competing societal claims. It differs from strict utilitarianism in that we no longer choose the course of action that brings about the greatest amount of value for a particular group; rather, we choose a course of action that is consistent with fundamental principles of justice and distributes benefits and burdens to all concerned groups in a way that maximizes the total good (value) of all the groups. Rawls provides a thorough analysis of a conception of justice which leads to the formulation of the following principles:

> First Principle: Each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all.
>
> Second Principle: Social and economic inequalities are to be arranged so that they are both: (a) to the greatest benefit of the least advantaged, consistent with the just savings principle, and (b) attached to the offices and positions open to all under conditions of fair equality of opportunity.
>
> First Priority Rule (The Priority of Liberty): The principles of justice are to be ranked in lexical order and therefore liberty can be restricted only for the sake of liberty. There are two cases: (a) a less extensive liberty must strengthen the total system of liberty shared by all; (b) a less than equal liberty must be acceptable to those with the lesser liberty.
>
> Second Priority Rule (The Priority of Justice over Efficiency and Welfare): The second principle of justice is lexically prior to the principle of efficiency and to that of maximizing the sum of advantages; and fair opportunity; (b) an excessive rate of saving must on balance mitigate the burden of those bearing this hardship (1971, p. 302-303).

One may realize that while Rawls' approach is geared to establishing a society (i.e., the formation of a political theory) it can also be implemented within the context of a society for the purpose of constructing social theory. It is interesting to note the duality in the logic of Rawls' approach. On one hand, the deontological system of an arrangement of principles and rules assures that all groups involved are entitled to basic liberties and in a hypothetical original position, vis., each group may know the probable outcome of a decision but may not know their own outcome and are therefore not in a position to gain advantage over another group. On the other hand, the principle of utility assures that the greatest amount of value for all of the groups involved is obtained, and not simply the greatest amount of good for one specific group. Students will no doubt find the notion of distributing goods (value) unequally as being fair a novel situation; but again, they also must understand that such a situation is only fair if an unequal distribution of the goods favors the least advantaged group and benefits the entire system as a whole. Using Rawls approach would appear to provide students with better guidelines for choosing a certain course of action in Figure two, particularly within the moral realm of the central square of the matrix. It reduces th problem of having to resort to a random selection procedure and replaces it with actions and scenarios that may be constructed and tested through reversible judgments. They must now mitigate any disvalue of long or short term consequences in a way that is consistent with the above principles of

justice while attempting to distribute any long or short term value to the greatest number of groups (or individuals).

Rawls' principles of justice represent a framework on which we can begin to construct policy decisions. There remains the questions of determining how the relative theoretical units of value or social good actually translate or impact on various groups. But by helping students to apply the traditional principles of utilitarianism and the pluralistic approach of Rawls, which combines utilitarianism with deontology to ethical problems, science educators will be providing them with a fruitful, functional approach to decision making at the social junction where ethics and science meet.

	X_1	X_2	X_3	X_4	X_5
Y_1	+	Y_1	Y_1	Y_1	Y_1
Y_2	X_1	+	Y_2	Y_2	Y_2
Y_3	X_1	X_2	?	Y_3	Y_3
Y_4	X_1	X_2	X_3	-	Y_4
Y_5	X_1	X_2	X_3	X_4	-

Figure 1

	X_1	X_2	X_3	X_4	X_5
Y_1	Y_1	Y_1	Y_1	Y_1	Y_1
Y_2	X_1	Y_2	Y_2	Y_2	Y_2
Y_3	X_1	X_2	?	Y_3	Y_3
Y_4	X_1	X_2	X_3	X_4	Y_4
Y_5	X_1	X_2	X_3	X_4	X_5

Figure 2

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