DOCUMENT RESUME

ED 443 711 SE 063 932

AUTHOR Bui, Thien-Ai Hong
TITLE Values under the Microscope: Teaching for Character in the Science Classroom.
PUB DATE 2000-00-00
NOTE 46p.; Master of Arts in Education Thesis, Biola University.
PUB TYPE Dissertations/Theses - Masters Theses (042)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Elementary Secondary Education; *Ethical Instruction; *Ethics; *Philosophy; Religion; *Science and Society; *Science Education; Teaching Methods; *Values Education

ABSTRACT

The decline in morality in the scientific arena and enterprise suggests a need for intervention in schools. This paper provides a rationale for the teaching of values in the science classroom through an evaluation of the current science curriculum, a discussion of the purpose of a science education, and an examination of the consequences of neglecting values in science. Educators are called to go beyond traditional science instruction and into values-based instruction. Teaching for character, which is essentially an application of values, is further emphasized and strategies for classroom and non-classroom instruction are provided. The paper also delineates the obstacles and dilemmas currently facing science teachers in the quest for character education and offers guidelines and Biblical principles for overcoming them. Despite the challenges facing values-based instruction and character education in the sciences, this paper contends that it is a worthy and important educational goal. (Contains 38 references.) (Author/ASK)

Reproductions supplied by EDRS are the best that can be made
from the original document.

SF.

ED 443 711

VALUES UNDER THE MICROSCOPE: TEACHING FOR CHARACTER IN THE SCIENCE CLASSROOM

A Thesis

Presented to

the Faculty of the Department of Education

Biola University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts in Education

By

Thien-Ai Hong Bui

Spring 2000

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

T. Bui

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

BEST COPY AVAILABLE

SP 039 932

ERIC

VALUES UNDER THE MICROSCOPE: TEACHING FOR CHARACTER IN THE SCIENCE CLASSROOM

M.A. Thesis

Presented to

the Faculty of the Department of Education

Biola University

La Mirada, California

USA

By

Thien-Ai Hong Bui

Spring 2000

Approved by:

Department Chair: _____ Date: 5/4/00

Capstone Chair: June Hetzel, Ph.D. Date: 5/2/00

Second Reader: _____ Date: 5/4/00

Copyright © 2000 by Thien-Ai Hong Bui

ABSTRACT

VALUES UNDER THE MICROSCOPE: TEACHING FOR CHARACTER IN THE SCIENCE CLASSROOM

Thien-Ai Hong Bui

The decline of morality in the scientific arena and enterprise suggests a need for intervention in schools. This paper provides a rationale for the teaching of values in the science classroom through an evaluation of the current science curriculum, a discussion of the purpose of a science education, and an examination of the consequences of neglecting values in science. Educators are called to go beyond traditional science instruction (i.e. dispensing information) and into values-based instruction. Teaching for character, which is essentially an application of values, is further emphasized and strategies for classroom and non-classroom instruction are provided. The paper also delineates the obstacles and dilemmas currently facing science teachers in the quest for character education and offers guidelines and Biblical principles for overcoming them. Despite the challenges facing values-based instruction and character education in the sciences, it is a worthy and important educational goal.

Introduction

It is improbable today to open a newspaper or hear a news report without being confronted with terms such as "cloning", "gene therapy", "prenatal screening", and "genetic engineering". Research and studies in the experimental sciences, particularly at the cellular and molecular level, are paving the way for exciting medical and biological advances. Undertakings like the Human Genome Project, an initiative to construct a genetic map of the DNA sequences in human chromosomes, are currently making tremendous strides. Such developments, however, have not been without its share of vices. Unethical practices at fertility clinics and in the medical field, for example, have made recent headlines. It seems that science has not only given us the tools to enhance the quality of life, but also the power to manipulate the processes of the natural, God-created order. The primary question this paper addresses is not to what extent should scientific inquiry and research be limited, but rather what can we do to ensure the ethical, humane, natural, and Biblical application of past, current, and future scientific discoveries?

The most likely and practical place to look for an answer is in the schools. Here is where learning takes place and here is where we must imbue in our children those values and skills which would enable them to make moral decisions in the field of science. Children need much guidance in making choices that align with godly values. A meaningful science education must take into consideration the current and future relationships and interactions between the student and the world around him/her (Asia and the Pacific Programme of Educational Innovation for Development [APEID], 1991; Cross & Price, 1996; Peters, Ono, Shimizu, & Hesse, 1997; Witz, 1996). Instruction, in other words, should not merely be one of dispensing scientific information and facts. Since science is not value-free (Nichols, 1995), it is imperative that teachers

take seriously the formulation of lessons that would give students practical guidelines in making ethical choices. Certainly, this would require that instructional strategies blend the knowledge of values with character formation. Character, in essence, is the application of values and assumes an understanding of those values.

The need to harmonize the teaching of science with ethical approaches to its application has been and continues to be an urgent one. One merely needs to take a brief look into history to see the devastation which science, when left morally and Biblically unchecked, has caused mankind. Furthermore, one need not be too imaginative to speculate what may occur twenty, ten, or even five years from now if practices involving immoral science manipulation goes unregulated. Indeed, what is now science fiction could one day soon become science fact.

For many educators, however, the need to inculcate values into a science curriculum poses significant difficulties. Issues such as time, resources, and legitimacy of instruction are all valid hindrances for the science teacher today (Asada, Tsuzuki, Akiyama, Macer & Macer, 1996). An attempt to offer guidelines for overcoming these obstacles are addressed in the paper. The key to success is in the recognition that, despite sometimes overwhelming challenges, teaching for character (i.e. applying values in day-to-day living) is not only a worthy educational goal, but also a necessary one.

Rationale for Teaching Values in Science

The Need for Values

Due to the potentially devastating effects that scientific knowledge and application can create, it would be "dangerous" not to teach values in the science classroom (Asada et al., 1996, p. 414). A dissection lesson, for example, that is devoid of respect for the animal being dissected may result in a student's callousness towards animals and animal rights. A human reproduction unit which neglects to guide students

towards an understanding of the sanctity and God-given preciousness of life may increase the already widespread tolerance for abortion. Or a health discussion on human experimentation with new drugs, in which the teacher fails to address the issues of ethical medical practices, may lead students to believe that all research and experiments done in the name of science are justified. Such omission of values from science teaching is one of the major factors contributing to the moral decay in the scientific arena and enterprise today.

In the area of genetics alone, numerous ethical considerations may arise. Most of the issues emanate from the applications of genetic technologies in the areas of birth and human procreation (Fujiki, 1986). Each year prenatal diagnosis and early detection techniques become more accurate and refined. Hereditary clinics and genetic counseling services, unsurprisingly in the past years, have become increasingly employed in our society (Fujiki, 1986). Kegley (1998), however, lists three areas of concern in regards to genetic knowledge: first, the myth that all problems can be explained genetically; second, the belief that genetic application is a cure-all; and third, the misuse of genetic testing which could be used to "discriminate, label, and stigmatize" (p. 4). Advances in genetic application have signified the importance of other major moral issues such as abortion of a child who is found to be abnormal or defective, artificial insemination for genetic purposes or personal lifestyle preferences, and genetically engineered reproductive cells (Fujiki, 1986). Vital questions will need to be answered: Where are we to draw the line in our ability to actively interfere with human life and development? Who will be the ones responsible for the decisions which could ultimately affect later generations? On what basis or truths are our decisions to be made? How are we steering away from the course of human nature which God designed?

Scientific endeavors are not conducted and should never be conducted merely for their own benefit. If experiments are planned and executed only because of scientific curiosity, there would be no end in the number of bizarre and frightening experiments that might arise. Although there are acknowledged limits to what scientists can currently accomplish, this limit is dictated more by technology than anything else (Vollrath, 1990). What happens when the technology improves? What if products of science are used not for the betterment of mankind but for its destruction? What if technology is used counter to God's will? How can we refrain governments or even terrorist groups from using science technology to develop "designer" toxins and pathogens (Vollrath, 1990)?

There is a social and spiritual responsibility which must be attached to all scientific pursuits. Scientists, health experts, governments, community leaders, church leaders and educators must work together. The fact is that science is concerned, not only with the scientific community, but also with the society at large. This concern is necessary for "ensuring the well-being of society and future security of mankind as a whole" (Rao, 1986, p. 2). If we allow scientific enterprise to step outside this realm of responsibility, we threaten the stability of the natural order and, consequently, the survival of humanity.

Schools should be in the vanguard in the pursuit of morality and responsibility in science. Many students today will become the leading scientists and decision-makers of tomorrow. We must now ask ourselves if we are equipping our children with the values necessary to make choices in the future that would please God. This is a formidable goal since the mass media and the social environment, in recent times, have led children to blatantly disrespect life (Asada et al., 1996). Violence and destruction of all kinds are all too common for this TV-and-video-games generation (Peters et al., 1997). Unsurprisingly, the decline of morality in our children today has led to a renewed and

vibrant interest in moral education or character education (Campbell, 1997; Lickona, 1991; Purpel, 1989; Vessels, 1998; Wiley, 1998). The current cry is for schools to more firmly and unapologetically convey, uphold, and reflect valued principles.

Purpose of a Science Education

It is widely recognized that the study of science and the pursuit of scientific knowledge is a meaningful human endeavor (APEID, 1991). Science, in effect, is about studying the world which God created. Further, the numerous contributions of science to the improvement of life is evident. As educators, however, what is our ultimate aim as we infuse our students with information about cells, DNA, and living organisms? What do our children need from a science education? Or better yet, what does our society need from a scientifically literate generation? These questions should be at the heart of a discussion on the purpose of a science education.

The popular response today is that in order to keep up with the rest of the world, the country needs more mathematicians and scientists, that students need more training in the pure sciences, and that a stronger academic preparation in the sciences will save people from poverty, crime and other evils of current society (Noddings, 1995). The belief that a knowledgeable population would be able to counteract the evils of society is, needless to say, an inaccurate one. Knowledge is not and will never be enough. The requirement is that there be a tight link between knowledge and moral use of that knowledge. We must remind ourselves that all that we have, particularly our knowledge, is from God. Therefore, we must use that knowledge not to glorify ourselves, but to glorify Him. We must use our knowledge not for selfish ends, but to help others.

Education, thus, must have two overarching goals: help students learn values and help students apply those values to everyday situations. The application of values belongs in the area of character education and development. Noddings (1995) decries the

fact that many educators are focusing more on making children first in the world of mathematics and science rather than helping children learn to be loving and respectful individuals. The focus in science education should not be so much on training students to be successful scientists, rather it should focus on teaching students to be God-fearing scientists. In addition, Noddings (1995) asserts that schools need "to reward excellence at every level, to ensure a place for every child and emerging adult in the economic and social world, to produce people who can care competently for their own families and contribute effectively to their communities" (p. 366). The main educational purpose should be a moral one. This is not to proclaim, however, that we abandon the teaching of science content and concepts in the classroom, only that there needs to be less stress on the technical issues and more on the critical moral issues (Purpel, 1989). Nichols (1995) asserts the following:

> It is important to introduce students not only to scientific information, but to inform them that decisions based on that information are inevitable. The more science they know, the more competent they will be to decide. But the decisions will not be value-neutral; they will incorporate the history of the student and will influence his or her (or others') future. Science is not just information; it is the expression of that information, and expression is seldom value-neutral. (p. 271)

A science education, therefore, should help students learn both the information and how to use that information for the common good. This educational focus would not only undergird the character of today's youths, but also the values of society. Academic achievement must align itself with ethical and social responsibility. By posing this sort of responsibility in the science classroom, we shall be "motivating and activating the minds of the younger generation to tackle future world problems" (APEID, 1991, p. 102).

Current Science Curriculum

It is commonly viewed that the sciences should teach objective and value free knowledge. In fact, it appears as if biology is still taught as a "pure" science only (Peters et al., 1997). This view that instruction in the sciences should be isolated from values is no longer tenable. Science curricula needs to be examined from the point of view of its moral and ethical component. Two questions for curriculum developers are these: Has the teaching of science contributed to the erosion of values? Is the best use being made of science for establishing values? The first question looks at the past, the second looks towards the future (APEID, 1991).

A science curriculum which only addresses content and skills will not produce citizens "with a wholehearted appreciation of and respect for science and the scientific world view, much less scientists for whom science is a path to higher inner fulfillment and who take full responsibility for all effects of their actions" (Witz, 1996, p.603). It is important that the curriculum provides young people with enough factual knowledge, but also draws attention to the problems which arise from human manipulation of nature, and show possible ways of dealing with these (Peters et al., 1997). We don't need to go through more textbooks, rather we need to help a student become a decent human being who may become a scientist (Sappir, 1998). Science curriculum, therefore, needs to stress topics such as bioethics, respect for life, human rights, uses of science, and research priorities in science, in which Biblical values are considered. According to Witz (1996), the curriculum should:

> Inspire students to develop a relation to living things as part of their overall relation to the world, such as being touched by the struggles, fates and consciousness of animals, a relation to the facts of eating and death, and awe and reverence for life. It should be a place which promotes a fuller, deeper feeling for

> and personal relationship to the fantastic web of life at its innumerable levels --- a deeper feeling for the character of animals, for habitats, ecosystems, and some of the processes in them. (p. 601)

A science curriculum concentrating so heavy on content may cause students to ultimately be unable to relate science to the larger goals of life, to the humane purposes of scientific research (APEID, 1991), and to the world which God created. Opponents have to recognize that moral education does not work against intellectual development or academic achievement. Rather, it supplies a firm foundation for both (Noddings, 1995).

The California Science Framework (1990) addresses values by stating that "values and ethics are important components of science teaching and must be considered by teachers, textbook authors, and curriculum writers" (p. 157). However, while it devotes five whole chapters to the nature, themes, and contents of a science education, it merely devotes one section of a chapter to ethics and values. The California science standards (1999) for middle school science, on the other hand, does not mention the incorporation of values into the core science content at all. While it addresses issues such as health and interpersonal relationships, it does not stress the teaching of values as it relates to specific scientific knowledge. Content in the pure sciences, instead, is addressed apart from values. Concepts concerning genetics, for example, are outlined with no mention of the societal impact and ethical ramifications of genetic advances. This lack of emphasis is a cause for concern and, clearly, a reordering of priorities is necessary. Unless science teaching is humanistic in terms of its content, its focus on the human factor in science, and its attention to the way the course itself is taught, then it is largely irrelevant to the needs of the present day students (APEID, 1991).

Consequences of Neglect

History has shown how scientific pursuits can go awry in the absence of moral guidelines and values. Some endeavors which began with noble intentions have ended up with horrific results. Throughout history, science has often been used and distorted for political gains. Indeed, when God is left out of the picture, a variety of disturbing symptoms may appear. If we do not teach values in the science classroom, we can expect continued manipulations and practices which compromise ethical and Biblical standards. Two historical examples in which we can see the consequences of neglecting values in science are the eugenics movement of the 1920s and the making of the atomic bomb.

Eugenics.

Eugenics is defined by Webster's Dictionary (1984) as "the study of and methods for improving a species genetically". In Germany, beginning in the 1920s, disputes regarding human heredity and the future of the human race set the stage for the subsequent degradation of the science of genetics in that country. One main concern for the eugenists and geneticists of the Weimar period was the genetic and evolutionary development of human society. Alfred Ploetz, for one, was a central figure in the German eugenics movement who supported the eugenic goal of a constantly improving biological base for society (Graham, 1981). His worry about the overall decline in the quality of future generations drove him to propose that married couples select the "best" of their own germ cells for fertilization (Graham, 1981). Ploetz, like many other eugenists, wanted to prevent the production of inferior offspring and to ensure that the ensuing generations were qualitatively somewhat superior to their parents. Needless to say, such proposals only left the road clear for less humane schemers.

When science is mixed with the struggle for power and racial superiority, only the deterioration of values can occur. Fritz Lenz was one of the leaders of the German race

hygienists who supported the ideas of racial eugenics (Graham, 1981). His philosophy was that science was value-free. "We must follow the facts of human heredity wherever they take us, and those facts tell us that man will genetically degenerate unless the strong and the fit are given advantages in propagation," he asserted (Graham, 1981, p. 229). Lenz was one of the scientists who applauded Hitler even before he came to power and whose political conclusions on the basis of his understanding of biology were highly favored by Hitler's party.

In Nazi Germany in the 1930s, the utopian dream became the ultimate eugenic nightmare. The genetic doctrines and practices of Nazi Germany, in effect, postulated the existence of genetic differences among races (Graham, 1981). Mandatory sterilization of the "hereditarily sick" began in 1933, less than six months after Adolf Hitler became chancellor. Euthanasia for "unworthy" children and adults, primarily the mentally ill, was instituted in 1939. The heinous policy of race hygiene reached its logical conclusion in the infamous "final solution to the Jewish problem" beginning in 1940 (Vollrath, 1990). The mass exterminations and the death camps were applications of a policy designed to protect the Aryan race from genetic contamination and degradation. In effect, the Germans in the 1930s used eugenics in such a horrifying way that the entire concept of eugenics was discredited (Graham, 1981).

How did eugenic ideas become so extreme and its application so atrocious? Eugenics, in the early years, was merely a faddish doctrine that was considered the latest application of science for the benefit of man (Graham, 1981). The political movement of eugenics began with legitimate concerns for social improvement. As the movement grew, however, it was mostly characterized by ideas which were inconsistent with the newly emerging science of human genetics (Vollrath, 1990). Two of these ideas were that mixing races through reproduction degraded the total human race and that society was threatened

by increasing number of persons with undesirable traits such as feeble-mindedness, epilepsy, prostitution, criminality, alcoholism, and laziness (Vollrath, 1990). Scientists espousing these ideas essentially manipulated the science of genetics and disregarded the social responsibility of science work. Due to their neglect of values and lack of reverence for God, eugenics became a tool of flagrant political power.

Eugenics is now a word in disrepute, but the use of genetic knowledge to exploit humankind is a far more viable possibility now than ever before. In effect, some of the dangers of the 1920s and 1930s are still with us. Prenatal diagnosis is a biomedical issue with ethical dimensions that has attracted much attention in recent years (Graham, 1981). In many societies today, a male child is preferred to a female child, and it is not surprising to see genetic technology utilized to support this societal preference. In fact, use of amniocentesis and other diagnostic procedures like ultra-sound for sex detection has led to increased sex selection. Sex selection is a common practice in many countries, like China and Korea. However, in no other country is medical technology so blatantly misused to discriminate against female babies as in India (Kumar, 1998). The practice of sex selection thrives in India because even some of the doctors find nothing wrong in it. "The general feeling among the doctors and others who support the practice is that it is much more cruel to bring a female into a world where she is unwanted, making her suffer throughout her life, than to eliminate her at a stage when her development has barely begun" (Kumar, 1998, p. 161).

Eugenics is still probably what people fear most when they think of recombinant DNA technology. One fear is that a despotic government could use the technology to create a generation of super strong, super intelligent, and super obedient citizens to conquer the rest of us. A second fear is that the powers controlling society will create different sorts of humans for different social positions, as described by Aldous Huxley in

his futuristic novel, Brave New World (Vollrath, 1990). Another fear is that scientists, trying to improve the race, will be tempted to conduct bizarre and dangerous experiments. Other fears are the unintended side effects of the applications. Germ line gene therapy, for example, carries the danger of passing therapeutic mistakes to future generations (Vollrath, 1990). To quell fears, there needs to be a conscious and concerted effort to imbue values and ethics into scientific works. Ultimately, there needs to be a return to God and to His commands for daily living and pursuits.

The atomic bomb.

The building of the atomic bomb can also give us clues to the consequences of neglecting values in science education. What do the bombings of Hiroshima and Nagasaki tell us about ourselves? More specifically, what do they tell us about scientists and their work? As far as science is concerned, Hiroshima and Nagasaki symbolize in a very dramatic way the power of the human intellect. The atomic bomb showed us how thoroughly the human mind could penetrate and manipulate the forces of nature. Physics, the most theoretical and esoteric of the sciences, generated the most powerful technological application of knowledge that anyone could imagine. But this power was unsettling as well as awe-inspiring.

The atomic bomb also called into question the traditional optimistic view of science. According to that optimistic view, science is necessarily good. It generates the knowledge we need to solve our problems and, by solving our problems, we improve our lives. Thus, science makes our world a better place in which to live. Notwithstanding, if the atomic bomb showed us anything, it showed how science could be dangerous as well as beneficial. The atomic bomb was the "first breach in our innocent conviction of the beneficence of science" (Sinsheimer, 1979, p. 91).

Why were the scientists committed to building such a destructive device? The historian, Martin Sherwin (1985), reports that the scientists involved in the project were "literally terrified" by the idea that the German scientists might be two years ahead of the Allies in the race to build the atomic bomb (p. 9). This, however, does not explain why the scientists continued working on the project even after they knew there would be no atomic bomb built by the Germans. In fact, the most common reason given for their drive to build the atomic bomb was pure and simple scientific curiosity --- the strong urge to find out whether the theoretical calculations and predictions would come true (Smith & Weiner, 1980). Those with a social conscience were in a minority. "The majority were not bothered by moral scruples; they were quite content to leave it to others to decide how their work should be used" (Rotblat, 1985, p. 18).

J. Robert Oppenheimer, scientific director of the program that designed and produced the atomic bomb, listed six motives that the scientists had for making the bomb. The list included such items as scientific curiosity and the sense of adventure. But the most important reason was that the creation of the bomb was an "organic necessity" (Smith & Weiner, 1980, p. 317). By this he meant that a scientist could not stop such a thing because the project reflected the basic goals of science. Those goals were to find out how the world works and to give humankind the greatest possible control over the world. When you come right down to it pride and the scientific motive were the reasons they did the job.

The Los Alamos scientists were among the very best physicists and chemists in the world. Perhaps a more accurate rendering of our initial question should be these: Were the scientists morally conscientious? Did they take into account the moral consequences of their professional decisions? Did they consider whether or not God would be pleased with their work? Did they appreciate the fact that many of their

decisions were moral as well as scientific? Were they concerned with the effects of their collective professional decisions? That is, did they think about how the world would be affected by what the community of physicists were doing? (Vollrath, 1990, p. 129)

As science educators, we must understand the significance of these questions. Are we training morally conscientious students? Are we teaching students to take into account the moral consequences of scientific pursuits? Do our students consider God's Word in their decisions? Do our students appreciate the fact that many of their decisions are moral? Are our students concerned with the effects of their decisions? Certainly, we can train our students and help them become great scientists; but, in the long run, it will not be beneficial if they do not attach values to their work. If teachers are not conscientious about their roles as moral educators, students might end up using science for their own selfish and, perhaps, evil ends.

Guidelines for Educators

By identifying values as we teach, we will be more able to help our children understand the importance of science to their daily lives. They will be able to understand the impact of science in their world, their community, and even their home. When students see how science relates to their lives and to social problems, they may become more interested in the subject. They are also more likely to remember the information they have learned (Wright, 1982). As we keep in mind the values inherent in science, we must also work to plan lessons in which all students will be able to apply the values they learned. Such an application of values will help in character formation. Again, our aim is not only to transmit information to our students but also to help our children become responsible and caring citizens. By helping students develop their values in the science classroom, one can positively influence their lives.

Values-based Instruction

The science education most of us received as educators most likely included instruction on how science is value-free and how data are neutral and objective (Nichols, 1995). Traditional science education emphasized concepts and facts, not value issues. Some students or teachers might not pay too much attention to these issues even if they were raised because these subjects are not required for university entrance examinations (Asada et al., 1996). This can no longer be the case. As science educators, we have tried too hard to promote the objectivity of science. It is time to admit that a good part of what we do as science instructors is value-laden. In any case, it is very difficult to deal with many substantive issues without exposing one's values (Nichols, 1995).

Finding values in science issues and topics.

Ethical and social issues associated with science are inherent in the science topics we teach. A conscientious science teacher really cannot avoid the fact that values are embedded in much of contemporary science (Kormondy, 1990). The teaching of values in science need not be a program add-on, but a process embedded in the current curriculum. Educators can focus, thus, on an ethics-across-the-curriculum approach or an infusional subject-based approach to teaching values (Vessels, 1998).

There are many issues in science, especially in medical sciences, where ethical considerations are prominent. One of the issues is that of the test-tube baby, where consideration of surrogate mother is also involved. Such considerations necessitates a formulation of values. Here, who will be the real mother, the one who has contributed her ovum or one who carried the baby for nine months? Another important issue is the amniocentesis test through which identification of the sex of the baby is possible in the third or fourth month of pregnancy, on the basis of chromosomes. Here, if a baby is found to be of unwanted sex, the pregnancy may be terminated. Would God be pleased

with termination? Is it ethical to do termination? Is it ethical even to conduct the test to do so (APEID, 1991)?

Students are generally aware of well-publicized scientific-social issues (e.g., abortion and ozone depletion), but they may know very little about their basic natures. To assist these students, teachers merely need to extend their present science material to touch the personal lives of their students. For instance, a topic that is common to most biology textbooks is genetics. Many teachers would agree that Mendel, DNA, and cell division are essential to the basic understanding of the field of genetics. However, students at this point may not be able to transfer this information into something that could be potentially valuable to them now and in the future. The common proposal is that teachers include in the science lessons topics and issues that relate directly to students' lives. For example, if students studying genetics are introduced to various ways in which genetic knowledge is used today, such as genetic counseling or screening, students may have a greater chance of recognizing how the basic concepts and principles that they have been investigating can assist them in gaining valuable information about themselves, their family, and their future. If these strategies are explored further, the students can also be confronted with some of the possible implications that the field of genetics poses to society. In other words, students would be able to consider some of the values issues that are present in this area of science and would simultaneously be given the opportunity to recognize how science is applicable to their lives (Barman, Rusch, & Cooney, 1981).

Most ethical issues related to world issues necessarily have to be presented as dramatically as possible in order to get the point across to students. The lifeboat syndrome is a good example. There are 22 people in the water, but the lifeboat will sink and everyone will drown if all 22 people get into it. The lifeboat can only take 20. In

using such an example, we can relate the dilemma to the current issues of food, energy, and resources shortage. If we believe there is a shortage of energy and resources in the world is it right to try to help every nation in the world, with the risk that all will "drown"? Would it be wiser to help those which have a chance of achieving a certain quality of life? What does the Bible have to say? Inevitably this raises ethical and philosophical issues which young people should begin to consider (Lewis, 1986).

Strategies for values-based instruction.

Values education can be addressed as an integral part of problem-solving and decision-making activities in the science classroom. This requires problems and decisions that extend beyond the technical into the moral and spiritual domain. Part of this learning/teaching strategy is to analyze the place of values in decision-making (APEID, 1991). One method of implementing this strategy is to use another person's struggle with values as an instructional tool. A teacher could use historical perspective to show how science and scientists are shaped by forces and factors around them and that scientists are products of value systems they adopt (Nichols, 1995). One assignment might be to study famous scientists and the story behind science. Such assignments can be morally beneficial since many scientists, like Louis Pasteur and Albert Einstein, were great humanitarians. Indeed, students can explore the intellectual and ethical values that are inherent in the practice of science through the study of biographies and case studies (APEID, 1991).

Value positions can also be the object of discussion, raised through philosophical inquiry, Biblical study, case study or simulation. The intention of discussions should be to clarify and explain a value system, or to make clear the interactions between knowledge, values and actions (APEID, 1991). For example, opportunities might be given to students to discuss ethical issues such as genetic engineering, experiments on

people and animals, and disagreements between businesses and scientists in the tobacco and asbestos industries. Students might also discuss the moral aspects of controversies in areas such as medical research, environmental legislation, or nuclear energy. Many students are not used to discussing these types of issues, especially in the science class. The myth is that science teachers are supposed to lecture, show films, and present demonstrations. Such myths have been a great detriment to science teaching today. Lively and informative discussions can be a part of any science class (Wright, 1982).

Debates, in addition, are useful and critical for teaching values. The class can be divided into two groups with each group instructed to defend one side of a controversial issue. By being forced to explain their reasoning and defend their beliefs during debates, students are more likely to internalize their values. A useful tool to further enhance the debate process is to have students also take the opposing view. Allowing students to analyze both sides of an issue will help students more clearly look at all the facts and information before coming to a conclusion. There are many ethical matters suitable for debate in the classroom: whether or not population control by the state is acceptable; to what extent is pollution justifiable in a country if the industry causing the pollution brings great economic benefit; to what extent is medical confidentiality an absolute right; whether or not a state has the right to decide who should have access to costly life-saving procedures; whether or not research results should be shared among nations or should be the proprietary rights of corporations; and, to what extent should risks be taken in human and animal research.

Stories are an important way of communicating values, raising issues for discussion, and demonstrating behavior. Stories can be used at all levels of schooling in the science classroom. They may be fiction, fable, biography, or case study, chosen to suit the level of understanding of the child (APEID, 1991). Stories with moral dilemmas

can help students develop their own values when confronted with similar situations, especially if they clearly identify with the characters involved. Other techniques available to the teacher for eliciting student ideas, feelings and experiences and for encouraging deeper examination of values are value sheets, role playing, contrived incidents, open-ended questions, values continuum, values voting, rank order, coded student papers, films and videos (APEID, 1991).

Essentially, in order to effectively teach values in the science classroom, the science teacher needs to link theoretical knowledge to practice and social/human purpose and they also need to link in-school experience to out-of-school experience. By doing so, students will be able to more clearly formulate their values and relate those values to the world around them.

Teaching for Character

Students must not only learn humane and Biblical values but must also be able to translate them into action. Character education combines direct teaching and relationship-building strategies in various ways to promote personal integrity, the development of moral virtues, and moral reasoning abilities (Vessels, 1998). Character education programs, in essence, concentrate mainly on behaviors which are consistent with particular values. The roots of character education are found in Aristotle's ethics and his recommendations for moral education. His primary contention was that children learn to be virtuous by behaving virtuously; thus, children must be taught to behave virtuously (Noddings, 1998).

Objectives for values and character education should, therefore, encourage children to internalize values, build them into their world view, and apply them towards daily living (APEID, 1991). Good instructional models for character education must take into consideration the need to develop in students a sense of moral responsibility and

commitment to values taught. Children need to learn values and character qualities such as courage, discipline, humility, endurance, kindness, faith, and love. By helping students develop these qualities, we are giving them tools which they can use in order to live, in a morally decaying world, without giving in to temptations and compromising situations. Character education must further develop in students the ability to think independently about moral issues and infuse moral instruction into all aspects of school life (Vessels, 1998). Children need to learn to make autonomous moral judgments, for in the real world they will not have moral adults guiding them at every step. Further, children need to know about Jesus for He is the best example of character there is.

Character through co-operative learning.

One method of helping students develop character in the classroom is to use co-operative learning strategies. Co-operative learning strategies are designed to facilitate students working together to solve problems and accomplish goals as a group. The term cooperative learning identifies a group of techniques that gives students the opportunity to work together and, in doing so, enhances their social, ethical, and cognitive growth in ways not provided by "competitive-individualistic structures and traditional recitation-presentation methods" (Vessels, 1998, p. 133). Co-operative learning methods provide an alternative to traditional teacher-centered approaches to teaching since their emphasis is on true collaboration and the sharing of resources. They share the key elements of positive interdependence, face-to-face interaction, social skills instruction, individual accountability, and group processing, all of which strengthen group functioning (Johnson and Johnson, 1994). Emphasis is placed on setting up interdependent goals structured so that students must learn to work together and as a team to complete a task. This strategy helps build a sense of community and fosters the teaching of critical life skills such as listening, taking the perspective of others, communicating one's thoughts, and resolving

conflicts (Lickona, 1991). They foster social consciousness and they help achieve the goal of balancing personal achievement with collective achievement (Berman, 1990). Finally, they entail significant decentralization of decision making and require teachers to facilitate learning and expand their focus beyond academics and information transmission (Sharan, 1994). Vessels (1998) contends:

> Co-operative learning promotes the highest levels of thinking and learning because students know that they may have to explain, discuss, and teach what they learn, may have to integrate information collaboratively and may have to engage in sophisticated dialogue to resolve conflicting opinions, explanations, and interpretations, and because they have the opportunity to observe and benefit from the thought processes, encouragement, and feedback of peers. (p. 133)

Character education is an essential part of co-operative learning because, in order for it to be beneficial, students have to treat each other with respect and care about how each is doing in the group. In co-operative learning groups, students have to learn to take responsibility for themselves and others, to be tolerant of different abilities and disabilities, and to have conversations in which respect is shown to everyone. In His training of the twelve disciples, co-operative learning was one of Jesus' main strategies. By sending His disciples out in twos to "drive out evil spirits and to heal every disease and sickness" (Mat. 10:1, New International Version [NIV]), Jesus was training them to depend on each other and to work together towards a common goal. Further, in the feeding of the five thousand men, Jesus gave His disciples the opportunity to work together to solve a big problem, namely feeding thousands with "only five loaves of bread and two fish" (Mat. 14:17, NIV).

Co-operative learning also helps create a climate which aids in character formation. The climate is important for it permeates every corner of classroom space, every minute

of the day, and every interaction that occurs in the room (Wiley, 1998). Through co-operative learning groups, the teacher can set up a climate through which students get to know each other, build friendships, and have a sense of community.

Class projects in which students work in co-operative groups can also be used to foster a climate of community since it is usually any undertaking in which students work together for a good cause. The project might be putting on a play, producing a science-related newspaper, organizing a fund-raiser for a science field-trip, community service learning or planning an anti-drug advocacy campaign. In actual teaching-learning situations of science, when pupils work on various projects and activities, they have to be self-dependent, self-disciplined, honest, self controlled and patient. As they follow the processes required to complete the projects, they develop the underlying qualities. The processes of inferring, predicting and communicating, develop attitudes for becoming honest. The processes of conducting experiments, interpreting data and making conclusions can develop patience, self control and honesty. If pupils work in groups, they have to get along well with each other. They have to learn how to share resources, cooperate with others, help out, respect, and listen to others. This helps them to be kind and considerate to each other, especially if the teacher draws attention to these attributes.

Character through community service.

Activities in community service are also a main teaching strategy. Jesus, Himself, emphasized the importance of community service projects like clothing and feeding the poor. Students can contribute to school life by organizing their science library or equipment room; the school radio service; the school kitchen, dining-area, and garden. They may run a zoo and a botanical garden, shops, a post office, school bank and museum. They can help in the local community by helping elderly people, taking care of monuments and public parks, collecting and recycling waste materials, cooperating with

firemen, and volunteering at the hospital (Frazer & Kornhauser, 1986). Effective service begins with and is grounded in the academic program. Community involvement brings academia and good character together through use of creativity in the promotion of moral ideals and service (Wiley, 1998).

Community service aids in fostering character for it provides environments and experiences which will allow students to develop a proper relationship to and appreciation of the object of study. Such a relationship will further generate inspiration for other higher values and contribute to the formation of a more comprehensive personal philosophy of life. If students can develop a proper and deeper relation to that which they are studying, it may become to them an important component of their larger relation to the world around them. Science, then, can indeed become a channel for higher inner striving and for realizing higher godly ideals. Such realizations will more likely prevent students from being affected by the many inner temptations and dangers posed by science today (Witz, 1996).

The belief that character building is one of the responsibilities of educators actually predates the first use of the term "character education" in America. Societies since the time of Plato have made moral education a deliberate aim of schooling and have educated for "character as well as intellect, decency as well as literacy, virtue as well as knowledge" (Lickona, 1991, p. 20). Philosophers as diverse as Plato, Aristotle, St. Augustine, St. Thomas Aquinas, Spinoza, Kant, Mill, and Dewey have viewed character education as vital to society. Jesus emphasized character formation over His entire three years of ministry. Throughout American history persons involved in public discussions about the purpose of schools have viewed character development as an important goal and one that must be routinely achieved if democracy is to survive. Teddy Roosevelt made the point succinctly when he said: "To educate a person in mind and not in

morals is to educate a menace to society" (as cited in Vessels, 1998, p. 5).

Teaching Beyond the Curriculum

Modeling.

Teachers, as moral agents, transmit values both by formal instruction and by becoming "moral exemplars" (Ryan, 1993, p. 6). Teachers possessing such qualities as humility, courage, impartiality, empathy, open-mindedness, enthusiasm, judgment, and imagination best achieve meaningful values education (Campbell, 1997). First and foremost, the creation of moral communities within classrooms and schools requires teachers who are models of good character, persons who want to share of themselves and reach out to others in a warm and helpful manner, who enjoy initiating positive and caring interactions with students, and who reflect Christ's character. Vessels (1998) further explains:

> They [teachers] must actively discourage selfishness and cruelty through swift intervention and must treat discipline problems as moral education opportunities. They must teach an ethic of interdependence that fosters empathy and the ownership of each class member's problems by all. They must help students to know one another well through activities and lessons that establish this as an objective. They must engage students in the process of making others feel important and good about themselves through techniques such as the good-deed tree, secret buddies, volunteer peer tutoring, and having students express appreciation to classmates during class meetings. They must teach a virtuous standard of conduct and encourage students to reward one another for adherence and challenge one another for nonadherence. They must allow students to participate in decision making that affects everyone in the classroom and must

encourage input that takes the feelings and well being of others into consideration. (p. 84)

Historically, the teacher has always been viewed as a moral leader in the classroom. Students look to the teacher to give them moral direction and guidance. The teacher's own character sets the moral tone of the classroom (Wiley, 1998). Leadership is often shown nonverbally, through body language such as posture, facial expressions, and movement. The teacher who conveys leadership has a positive effect on student behavior. The foremost trait of teachers should be that they have high moral character and that they display the same universal values which they want students to acquire. The life of the teacher is in some ways an open book to students. Students learn from what teachers say and do. There must be a consistency of message and action for character education to be effective. Undoubtedly, teachers must practice what they preach, for much of character education that occurs in the classroom is caught not taught.

To be guides in morality and ethics, teachers must understand the complex moral role that they occupy as professionals and appreciate the significance of their own choices and actions on the students in their care (Campbell, 1997). The teacher, as the source of knowledge and ideas in the classroom, greatly influences the child's world views. The manner by which he/she conducts himself/herself and guides children in the course of the day's activities may facilitate or hinder the self-concept and character development of the child (APEID, 1991). The teacher plays an irreplaceable role in the promotion of excellence and values. A teacher's influence on her students lasts for a lifetime. The influence is not limited to scientific activities, but encompasses many aspects of life. The most durable influence of the teacher is not the substance of what is taught but in the manner of teaching. In fact, the most precious acquisition a student or a younger scientist receives may have little relation to the professional expertise or intellect of the teacher.

What remains most in the student's memory and in his character is the personality of the teacher (Rao, 1986).

Some would argue that the components of teaching as both a knowledge endeavor and as a moral enterprise are essentially inseparable and that recognition of this fusion is key to the conception of the teacher's role (Campbell, 1997). Teachers, even without intending to act as moral agents, extend their influence through all that they say and do and, in so doing, can inadvertently teach an attitude or value. Any decision or action that a teacher selects indicates her values for that specific situation. A teacher's response or reaction to a situation can greatly influence a student's behavior in the future. Such influence is powerful; thus, teachers must take their roles seriously.

The most important ingredient of students' values and character education are the teachers, their personality, their knowledge of the subject, and their knowledge of the teaching and learning process. Consequently, teachers must not stop in their development. They must systematically and purposefully add to and broaden their knowledge and experience, improving their educational skills (APEID, 1991). Adolescents deeply resent dicta from their elders that signal "do what I say, not what I do". One cannot reform the school if teachers by their actions signal contempt for the desired values. They must live the values for which they stand. Adult lives that mock values are living hypocrisy and are breeding cynicism in the young (Wiley, 1998).

The hidden curriculum.

It has become fashionable in recent years to speak of the school's "hidden curriculum" --- school experiences that result in unintended, unplanned, and even unsuspected student learning. The "hidden" curriculum is typically contrasted with the "formal" curriculum --- the experiences purposely set up to accomplish the intended goals and objectives of the various curriculum areas. The hidden curriculum includes the

unintended implications of content and of teaching behavior, as well as the many non-instructional encounters that students have with teachers and other school people. Much of the hidden curriculum has to do with values, even in subject areas that are frequently considered value free, such as science. "To the extent that science teaching is faithful to science, the hidden curriculum should reflect such values; indeed, one may even expect them to be an intentional part of the formal curriculum" (Shaver & Strong, 1976, p. 3).

It is important to remember that as each teacher interacts with students, in and out of the classroom, as part of the social and political system of the school, much teaching takes place. Overhearing student conversations in the hallways clearly shows how students learn far more about teachers than about the subject matter that is taught. One may choose to ignore this part of a teacher's impact on students, but it is "naive to deny its existence" (Nichols, 1995, p. 268). The teacher's role is an ethical one, not simply a technical one. Young people are constantly monitoring the adults around them which indicates that the hidden curriculum has a very real effect on what students learn (Kidder & Born, 1999).

Overcoming Difficulties

Values education are often avoided by classroom teachers due to a variety of reasons. The following reasons might be familiar: *I don't have time for another add-on. We are already expected to teach too many extras. I don't have time in the school day, and I don't want to do one more lesson preparation. I don't know where to start. I don't have any materials or resources. I don't want to mess up on such an important topic.* Essentially, many science teachers feel unprepared to deal in an instructionally effective way with values issues (Barman et al., 1981). Others are bombarded by the pressure to cover so many textbook chapters by a particular date, inadequate media and laboratory

resources, too many students, discipline problems, and lack of administrative support.

At the same time, teachers are confused about when, where, and how to use such skills, and are frustrated by a number of organizational difficulties, such as syllabi and time. Cross and Price (1996) further explain:

> Student teachers and experienced science teachers alike want to know whether they are alone in wishing to help students come to an understanding of the social relations of science; whether in doing this the teaching of traditional scientific concepts and knowledge will be sacrificed; where they can find resource materials; the effect of destroying the myth of value-free scientific knowledge; the difficulty of teaching evaluation of evidence and making judgments; and the problem of students who wish to become activists as a result of their learning experience. (p. 322)

Despite the difficulties, the good news is that many science teachers understand the importance of teaching values and are finding ways to teach about the ethical dimensions of global scientific-social issues (Frazer & Kornhauser, 1986).

Time.

The constraints placed on teachers by curricula overstuffed with content is a common theme. Most teachers feel they do not have enough hours in the school day to add another subject or strand, such as values and ethics. A commonly asked question is this: "How will I get this material into my course when I can't complete my present syllabus?" A related explanation for failure to respond to ethical issues teaching, particularly at the primary level, is the tremendous pressure placed on schools for assuring student achievement in reading, language, and mathematics. Teachers tend to channel their energies to bring about student attainment in these areas at the expense of accomplishment in science and social studies (Frazer & Kornhauser, 1986). Teachers are

also trapped in the fact that traditional science curriculum requires a certain content to enable students to get into college (Cross & Price, 1996).

To overcome the constraints on time, teachers must recognize that some things will probably have to be omitted from the present curriculum in order to accommodate the addition of values lessons. This, however, does not necessarily mean that the quality of the course with respect to content and process objectives must suffer. The addition of values-related objectives to the science curriculum will actually enhance the course and provide students with more motivation for developing those concepts than they previously had. Furthermore, areas and topics which have only marginal significance with respect to the main goals of the existing science course can be streamlined to accommodate values lessons without compromising primary objectives (Barman et al., 1981). Character education, in addition, can be infused into the established curriculum by looking for the moral issues that naturally arise in the subject matter.

Resources.

Teachers often bemoan the difficulties in obtaining a range of resources for teaching about controversial issues. Due to the lack of emphasis on values education in science, most teachers do not have sufficient access to materials in order to teach values (Asada et al, 1996). This lack of resources consequently leads to feelings of dissatisfaction with lessons in which issues were discussed (Cross & Price, 1996).

Should science teachers, therefore, abandon the teaching of values? Certainly not. Although such inconveniences require that teachers put in more hours to prepare values lessons, the teaching of values in science is critical enough to necessitate the extra effort. Besides, it is difficult to pick up a newspaper, popular magazine, or science periodical today which does not provide some type of information on controversial issues. Such controversial issues, indeed, are of great use in values education. Among the most easily

accessible resources for science teachers are the following professional journals, all of which offer either a special section on controversial issues or which maintain a relatively constant flow of articles relating to such issues: The Science Teacher, The American Biology Teacher, and Science (Barman et al., 1981). A careful perusal of the issues of these journals will supply a wealth of ideas and topics which can be continuously supplemented by current periodicals, newspapers, television, and radio.

Nevertheless, in order to conduct values and character education effectively, the data suggest a need for the development of higher quality materials (Asada et al, 1996). Providing teachers with a framework with which they can produce teaching resources that deal with controversial issues is an urgent task. "Teaching resources should provide students with opportunities to explore the richness of the interactions between science and society rather than being confronted with a limited two-sided debate about an issue" (Cross & Price, 1996, p. 330).

Training.

Another explanation for the reluctance of science teachers to touch the ethical dimensions of their content is that many are unwilling or unable to break out of traditional science teaching methods and models. Students are given little opportunity to develop those skills necessary to formulate questions, search for and evaluate evidence, and grapple with the difficulty of making practical decisions on controversial issues where experts disagree or the evidence is inconclusive. "Science is still largely taught as if it were objective and value free, and theories are taught as facts" (Cross & Price, 1996, p. 329). It has been difficult to prepare science teachers in sufficient numbers that venture far from route presentation of content and concepts. Indeed, because of the emphasis on academic instruction, many public school teachers deny any obligation to engage in moral education. When urged to so, many respond by saying that moral education is not their

"field of expertise" and that they are untrained to do such work (Noddings, 1998, p. 121).

Teacher training courses, thus, must recognize the need to effectively train preservice teachers for their future role as moral educators. Courses should help raise the awareness of teachers to a point where they can develop a reflective appreciation for the values underlying their actions. This process of reflection should increase the teacher's "awareness of the ethical dimensions of their future roles, prepare them to assess possible avenues for decision making, and encourage them to anticipate situations and dilemmas so as to be better equipped to deal with them" (Campbell, 1997, p. 258). Such programs would greatly help teachers develop more confidence in dealing with values and ethical issues in their classrooms.

Learning how to teach science within a framework of teaching values and teaching for character is a contentious issue; however, it is not an insurmountable one. Controversial issues are a part of real life and, therefore, they are issues around which students can more effectively interact. In order to "make our science classes as relevant as possible, we need to seriously consider using such issues" (Barman et al., 1981, p. 69). It seems quite likely that such controversies which relate to science and the citizen will continue to develop in the future, perhaps at an increasing rate. This means that students will have ample opportunity for becoming involved in such controversies, and that, consequently they can profit from analysis of such issues and activities in their formal science education. A working knowledge of how to investigate such issues and how to participate effectively in public science policy decision-making will be an increasingly valuable asset to young people (Barman et al., 1981).

The Real Obstacles Facing Educators

Despite the continued work and research to help teachers overcome issues of time constraints, lack of resources, and insufficient training in values education, there continues to be a reluctance on the part of many teachers to engage in teaching that confronts values, beliefs, and ethical judgments. There are certainly professional risks to the teacher who engages in such teaching without a strong sense of how to proceed, clear goals, and community respect. Without making a single judgmental statement, a science teacher can suddenly become the focus of serious controversy. Barman, Rusch, and Cooney (1981) explain:

> In this country [United States], there are many regions in which mention of organic evolution or the age of the earth by a teacher can result in a variety of reprisals and admonishments. These can range from a call from a concerned parent to court proceedings and action for the teacher's dismissal. Regardless of what may be said about academic freedom, freedom of speech, and separation of church and state, the community pressure and reaction against certain scientific ideas in many localities in this nation remains strong and undiminishing. (p.55)

Policy makers, administrators, and parents often worry that legitimation of stories and ordinary conversation will give teachers license to indoctrinate their children. These worries reflect a deep and pervasive distrust of teachers, a distrust extended today to almost all professionals and public workers. Such distrust is part of the general moral malaise that underlies the decline in youth character. Youth, however, cannot develop sound character unless they associate with adults of sound character who are willing to share themselves as persons (Noddings, 1998). Furthermore, students too often feel, legitimately, that the school and its staff are "plastic, insulated, and isolated from the real world as the students see and feel it. This feeling that the school and its professional

personnel are artificial [unable to relate to the real world and real life issues]. . . are among the reasons why teachers often have little influence on their students" (Shaver & Strong, 1976, p. 76).

Many teachers, in addition, are concerned about the moral significance of teaching certain topics and using specific materials. They are concerned about the effects their decisions have on students. They worry about issues of indoctrination and their professional and ethical rights to determine what should and should not be included in the curriculum. The dilemmas are compounded when parents complain about the substance of their courses. This presents not only political problems within the school but ethical problems for teachers who want to ensure that their students are well served educationally and morally by their choice of curriculum (Campbell, 1997).

The primary concern most people have are: *Whose definition of good? Whose values system will be taught? Who is to say what is right and what is wrong? Who are you to tell me or my child what is right and wrong? Do shared moral values exist? Don't we all have different values? Are we not compelled to respect the tremendous diversity of values in the educational arena?* Such concerns have prevented many teachers from addressing values in their classes. Nonetheless, a closer look at the issue reveals that the concerns are essentially unfounded.

The only values taught in character education are those all rational people agree are necessary. They are called universal values (Lickona, 1991). Universal values are upheld by every civilized culture, religion, and belief system (Ryan, 1986). In fact, society cannot exist without them. There is a common moral ground and there is a unifying morality about which all children very much need to learn. "It is a myth that all morals are individual, personal, and situational" (Wiley, 1998, p. 18). Educators, thus, have an obligation to teach this common core of values to children.

Research done by the Institute for Global Ethics in 1991 identified compassion, honesty, fairness, responsibility, and respect as the five ideas which appear to be at the heart of humanity's search for its shared values (Kidder & Born, 1999). Most of these values are so universal that according to the research, they are part of most religious perspectives. Such findings indicate a reasonable assurance that nobody will feel left out of the dialogue if values are discussed in the classroom. Teachers need not feel, therefore, that they are imposing values on students since these core values can be found everywhere, even in communities divided by culture, race, language, or religion (Kidder & Born, 1999). "Regardless of our diversity --- at root we share a basic morality that includes such virtues as responsibility, respect, trustworthiness, fairness, caring, and civic virtue" (Sergiovanni, 1996, p. 123).

When schooling touches on values, it is the parents who are most likely to emotionally react. For that reason, any teacher who decides to deal with values explicitly ought to have a conscious rationale as a foundation for his or her approach. Communication of this rationale to other teachers, to the principal, and even to the superintendent, may help to insure that vital support will be available if needed. Moreover, going through the process of discussing your rationale with other school people may help you to communicate it later to parents and to persuade them of its soundness (Shaver & Strong, 1976). Vessels (1998) advises:

> Schools, school systems, and states that wish to plan and implement character education programs without controversy or litigation must (1) demonstrate an awareness of relevant constitutional principles and court opinions that support character education; (2) focus on widely shared civic, moral, and prosocial values that transcend cultural and religious differences, as articulated by Horace Mann; (3) respectfully include persons from all points of view in discussions of what

> values to teach and how to teach them; and (4) communicate effectively with parents, students, and school personnel on the purposes and goals of character education. (p. 11)

Although teachers must gather support for values education, they must remember that it is not illegal to teach values in the classroom. In 1995 school superintendents received from Secretary Riley and the U.S. Department of Education (as cited in Vessels, 1998) a document which was designed to dispel confusion about the implications of U.S. Supreme Court decisions concerning religious expression and the teaching of moral values:

> Though schools must be neutral with respect to religion, they may play an active role with respect to teaching civic values and virtue, and the moral code that holds us together as a community. The fact that some of these values are held also by religions does not make it unlawful to teach them in school. (p. 6)

Conclusion

Science is a powerful tool. As educators, we would be doing a great disservice to the teaching of science, and consequently to future generations, if we neglect to address values in our science classroom. By addressing values inherent in science, we are doing more than helping our students recognize values, we are helping them internalize values and formulate those values into personal character. Such character is desperately needed in society's declining morality and decay in social responsibility. The future of science is in the hands of today's students. The potency of science to enhance as well as to destroy is clear. We must educate our children to study science and to apply scientific knowledge for good, not for evil.

The true problem concerning pervasive and possible unethical scientific practices stems not so much from the challenges facing educators in the science classroom, but rather from the moral battles fought daily in society. How can well-meaning educators

combat the overpowering influences of mass media and the even more dominating authority of the state, which has in recent years so effectively withdrew its connection to the church, and ultimately to God? Historically, American education attached itself to Christian values. Now, however, we have gone as far as to take God out of schools. Since then nothing has been the same, for such detraction has only left giant gaps for schools and educators to fill. Needless to say, God cannot be replaced.

Senseless violence, vicious crimes, unethical practices, and blatant disrespect for life are prevalent in all communities and at all societal levels. For science educators, the questions are many. How far have we steered from helping students understand the moral obligations of scientific knowledge? Are we consciously trying to help shape our student's sense of right and wrong? Has our method of teaching science become so mundane that students are unable to relate their in-class learning to the value-laden issues around them? Most importantly, how can we get back to teaching about the natural order which God intended? It is clear that the problem is deeply rooted and consequently more difficult to uproot than it seems. What then is the task facing schools and educators at this juncture? One answer lies in a reassessment of morality, and inevitably a reassessment of our relationship with our Maker, not only in terms of science education but education in general.

Without values and character, we are in grave danger; but, there is hope. That hope lies in Jesus Christ and in His Word. Only a true belief in Jesus and a firm commitment to His commands can lead us out of the quagmire of moral decline. As educators, we need to help our students realize this important truth. We need to help students understand that all things were created by God, for God, and that without God life is empty. In terms of science and scientific pursuits, we must teach our students that all knowledge is from God and that endeavors must be done to glorify God. With God's

guidance and strength, we can maintain our godly values and character in the classroom and school environment. In doing so, we can help our students develop theirs.

Ultimately, our goal is not only to help our students be good citizens, but to help them become a part of God's family. Each day, as long as we are given the privilege to teach, we need to remind ourselves of the Great Commission (Mat. 28:19-20, NIV): "Therefore go and make disciples of all nations baptizing them in the name of the Father and of the Son and of the Holy Spirit, and teaching them to obey everything I have commanded you."

References

Asada, Y., Tsuzuki, M., Akiyama, S., Macer, N. Y., & Macer, D. R. J. (1996). High school teaching of bioethics in New Zealand, Australia and Japan. Journal of Moral Education, 25(4), 401-420.

Asia and the Pacific Programme of Educational Innovation for Development. (1991). Values and ethics and the science and technology curriculum: A sourcebook. Bangkok, Thailand: UNESCO-PROAP.

Barman, C. R., Rusch, J. J., & Cooney, T. M. (1981). Science and societal issues: A guide for science teachers. Ames, IA: Iowa State University Press.

Berman, S. (1990). Educating for social responsibility. Educational Leadership, 48(3), 75-80.

California Department of Education. (1990). Science framework for California public schools kindergarten through grade twelve. Department of Education, 721 Capitol Mall, Sacramento, CA 94244.

Campbell, E. (1997). Connecting the ethics of teaching and moral education. Journal of Teacher Education, 48(4), 255-263.

Cross, R. T., & Price, R. F. (1996). Science teachers' social conscience and the role of controversial issues in the teaching of science. Journal of Research in Science Teaching, 33(3), 319-333.

Frazer, M. J. & Kornhauser, A. (Eds.). (1986). Ethics and social responsibility in science education. Oxford: Pergamon Press.

Fujiki, N. (1986). Bioethical considerations concerning the clinical application of human genetic knowledge. In M. J. Frazer & A. Kornhauser (Eds.), Ethics and social responsibility in science education (pp. 103-108). Oxford: Pergamon Press.

Graham, L. A. (1981). Between science and values. New York: Columbia University Press.

Johnson, D. & Johnson, K. (1994). Learning together. In S. Sharan (Ed.), Handbook of cooperative learning methods. Westport, CT: Greenwood Publishing Group.

Kegley, J. A. K. (1998). Genetic information: Caution, cooperation, and human values. In J. A. K. Kegley (Ed.), Genetic knowledge: Human values & responsibility (pp. 3-5). Lexington, KY: International Conference on the Unity of the Sciences.

Kidder, R. M. & Born, P. L. (1999). Resolving ethical dilemmas in the classroom. Educational Leadership, 56(4), 38-41.

Kormondy, E. J. (1990). Ethics and values in the biology classroom. The American Biology Teacher, 52(7), 403-407.

Kumar, K. (1998). Amniocentesis and gender discrimination. In J. A. K. Kegley (Ed.), Genetic knowledge: Human values & responsibility (pp. 147-166). Lexington, KY: International Conference on the Unity of the Sciences.

Lewis, J. L. (1986). Ethics in the classroom. In M. J. Frazer & A. Kornhauser (Eds.), Ethics and social responsibility in science education (pp. 145-147). Oxford: Pergamon Press.

Lickona, T. (1991). Educating for character: How our schools can teach respect and responsibility. New York: Bantam Books.

Nichols, J. R. (1995). Values and biology education. The American Biology Teacher, 57(5), 268-271.

Noddings, N. (1995). A morally defensible mission for schools in the 21st century. Phi Delta Kappan, 76(5), 365-68.

Noddings, N. (1998). Moral education as a form of life. In J. T. Sears & J. C. Carper (Eds.), Curriculum, religion, and public education: Conversations for an enlarging public square (pp. 116-125). New York: Teachers College Press.

Peters, M., Ono, Y., Shimizu, K., & Hesse, M. (1997). Selected bioethical issues in Japanese and German textbooks of biology for lower secondary schools. Journal of Moral Education, 26(4), 473-489.

Purpel, D. E. (1989). The moral and spiritual crisis in education: A curriculum for justice and compassion in education. New York: Bergin & Garvey Publishers, Inc.

Rao, C. N. R. (1986). Ethics in relation to science and technology education and development. In M. J. Frazer & A. Kornhauser (Eds.), Ethics and social responsibility in science education (pp. 1-12). Oxford: Pergamon Press.

Rotblat, J. (1985). Leaving the bomb project. Bulletin of the Atomic Scientists, 41, 16-19.

Ryan, K. (1986). The new moral education. Phi Delta Kappan, 68(4), 228-233.

Ryan, K. (1993). Why a center for the advancement of ethics and character. Journal of Education, 175(2), 1-11.

Sappir, S. (1998). Global ethics in a high school curriculum. Educational Leadership, 55(6), 80-82.

Sergiovanni, T. J. (1996). Leadership for the schoolhouse: How is it different? Why is it important? San Francisco: Jossey-Bass.

Sharan, S. (1994). Cooperative learning and the teacher. In S. Sharan (Ed.), Handbook of cooperative learning methods. Westport, CT: Greenwood Publishing Group.

Shaver, J. P. & Strong, W. (1976). Facing value decisions: Rationale-building for teachers. Belmont, CA: Wadsworth Publishing Company, Inc.

Sherwin, M. (1985). How well they meant. Bulletin of the Atomic Scientists, 41, 9-15.

Sinsheimer, R. L. (1979). Two lectures on recombinant DNA research. In D. A. Jackson & S. P. Stitch (Eds.), The recombinant DNA debate (pp. 85-89). Englewood Cliffs, NJ: Prentice-Hall.

Smith, A. K. & Weiner, C. (1980). Robert Oppenheimer: Letters and recollections. Cambridge, MA: Harvard Press.

Vessels, G. G. (1998). Character and community development: A school planning and teacher training handbook. Westport, CT: Praeger Publishers.

Vollrath, J. (1990). Science and moral values. Lanham, MD: University Press of America, Inc.

Wiley, L. S. (1998). Comprehensive character-building classroom: A handbook for teachers. DeBary, FL: Longwood Communications.

Witz, K. G. (1996). Science with values and values for science education. Curriculum Studies, 28(5), 597-612.

Wright, J. D. (1982). Teaching science today. Portland, MA: J. Weston Walch.

SE063932

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE

(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Values Under the Microscope: Teaching for Character in the Science Classroom	
Author(s): Thien-Ai H. Bui	
Corporate Source: Biola University	Publication Date:

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic media, and sold through the ERIC Document Reproduction Service (EDRS). Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce and disseminate the identified document, please CHECK ONE of the following three options and sign at the bottom of the page.

The sample sticker shown below will be affixed to all Level 1 documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

1

Level 1

☒

Check here for Level 1 release, permitting reproduction and dissemination in microfiche or other ERIC archival media (e.g., electronic) *and* paper copy.

The sample sticker shown below will be affixed to all Level 2A documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE, AND IN ELECTRONIC MEDIA FOR ERIC COLLECTION SUBSCRIBERS ONLY, HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2A

Level 2A

☐

Check here for Level 2A release, permitting reproduction and dissemination in microfiche and in electronic media for ERIC archival collection subscribers only

The sample sticker shown below will be affixed to all Level 2B documents

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Sample

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Level 2B

☐

Check here for Level 2B release, permitting reproduction and dissemination in microfiche only

Documents will be processed as indicated provided reproduction quality permits.
If permission to reproduce is granted, but no box is checked, documents will be processed at Level 1.

I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce and disseminate this document as indicated above. Reproduction from the ERIC microfiche or electronic media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries.

Sign here, → please

Signature: Ai Bui	Printed Name/Position/Title: Thien-Ai H. Bui
Organization/Address: Biola University / Education Dept. 13800 Biola Ave. La Mirada, CA 90639	Telephone: (562) 428-8770 FAX:
	E-Mail Address: thienaibui@aol.com Date: 5/1/00

(over)

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of the document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents that cannot be made available through EDRS.)

Publisher/Distributor:
Address:
Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant this reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name:
Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

However, if solicited by the ERIC Facility, or if making an unsolicited contribution to ERIC, return this form (and the document being contributed) to:

ERIC Processing and Reference Facility
1100 West Street, 2nd Floor
Laurel, Maryland 20707-3598

Telephone: 301-497-4080
Toll Free: 800-799-3742
FAX: 301-953-0263
e-mail: ericfac@inet.ed.gov
WWW: http://ericfac.piccard.csc.com

ERIC