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ABSTRACT

It is the purpose of this paper to describe and analyze the "moral content" of six preservice science "methods" textbooks. Six recently published textbooks, including both elementary and secondary levels, were examined by way of a method which attempted to identify those text segments with "explicit moral guidance." The paper reports on the degrees of "moral avoidance" or "moral confrontation" found in this selection of sources. Overall, the texts were highly variable. One text suggested the teachers should use controversies in instruction, yet warned the teacher against the imposition of any moral stance upon the students. Toward the other end of the spectrum, another methods text encouraged conscious moral development in both teacher and student and embraced the teacher's role in moral education specifically. Implications of these results for science educators are discussed. Finally, the need for contributions toward improving "moral content analysis" is discussed. (Author)

THE MORAL CONTENT OF SCIENCE "METHODS" TEXTBOOKS

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The Moral Content of Science "Methods" Textbooks

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> Since all education is moral education, no teacher can safely hide beneath the cloak of subject-matter expertise (Martin, 1992, p. 168).
>
> All science students, however, will become citizens. . . . All will be decision makers concerning matters of science and technology, either willfully . . . or apathetically via the lack of such participation (Ramsey, 1993, p. 254).

Abstract

It is the purpose of this paper to describe and analyze the "moral content" of six preservice science "methods" textbooks. Six recently published textbooks, including both elementary and secondary levels, were examined by way of a method which attempted to identify those text segments with "explicit moral guidance." The paper reports on the degrees of "moral avoidance" or "moral confrontation" found in this selection of sources. Overall, the texts were highly variable. One text suggested the teacher should use controversies in instruction, yet warned the teacher against the imposition of any moral stance upon the student. Toward the other end of the spectrum, another methods text encouraged conscious moral development in both teacher and student and embraced the teacher's role in moral education specifically. Implications of these results for science educators are discussed. Finally, the need for contributions toward improving "moral content analysis" is discussed.

The major features of this paper are 1) a descriptive report of the explicit "moral content" found in five selected methods textbooks, all of which were published after 1986; 2) analysis of the findings, and 3) a critique of the analytical techniques employed.

Introduction

Moral education is the focus of a surge of interest among parents, politicians, educators (including science educators) and scholars. Evidence supporting this claim is readily available from a variety of sources, including the proceedings of the 1992 Republican National Convention, new book titles, columns and features in weekly news magazines, the tables of contents of educational and philosophical

journals, and the formation of new special interest groups within educational research organizations. Parallel and germain to this surge, interested scholars may follow discussions about objectivity (e.g., Cordero, 1992), the infusion of STS materials in science content texts (e.g., Chiang-Soong & Yager, 1993) and courses (e.g., Shankar & Skoog, 1993), the legal implications of values education (Shaw, 1992) and the moral implications of being a teacher educator (e.g., Tom, 1992). Clearly, it matters to our society how our childrens' moral education proceeds. Consequently, it should matter to us whether and how we educate our teachers to deal with morally-laden curriculum (Tom, 1992).

Rationale

While research into the ethical sensitivities of preservice professionals provides one kind of forecast of eventual practice (Bebeau, 1992), textbooks also provide an opportunity to examine what a majority of America's teachers "choose" to teach and how they choose to teach it (Weiss, 1987; Blystone, cited in National Research Council, 1990, p. 27; Chiang-Soong & Yager, 1993, p. 340). Given the data indicating teacher adherence to and satisfaction with currently available *classroom* science textbooks, and given the social milieu alluded to in the previous section, we would have some reason to wish to examine the "moral content" of such textbooks. When it comes to teaching our children science for the 90s and beyond, what do these texts explicitly teach regarding moral behavior? Implicit, or between-the-lines moral positions have already been identified as areas worthy of examination (Martin, 1991). Proponents of STS argue for inclusion of such material in science texts on the basis of its potential to "achieve the much-sought end of social responsiblity" (Ramsey, 1993, p. 255). While many of us in science education may feel optimistic given the current blitz on science education reform, Ramsey's well-argued message is that most current national-level reform efforts fall short of connecting content with social responsibility. He points to STS and the History and Nature of Science and Technology (HNST) curricula as being the "only movement(s)" which thoroughly address such concerns (p. 247). The objectivity-subjectivity debate (e.g., Eisner, 1986; Barone, 1992; Cordero, 1992), discussion of the gender-bias in normally-presented scientific information (Martin, 1991; Warren, 1988), and Munby's (1976) analysis revealing the absence of contextual reminders within factual-sounding portions of science texts--all could raise our level of concern regarding even the most "morally neutral" and traditional classroom teaching practices.

Separate from analyses of classroom textbooks, however, we might benefit from a focused analysis of the moral content found in "methods" texts. Such is the purpose of this paper. Teachers--clearly the ultimate arbiters of classroom textbook use practices--must derive their pedagogical content knowledge in some part from their preservice training. Finding and analyzing those portions of elementary and secondary methods texts which can be reasonably identified as containing explicit moral guidance to the teacher could reveal ways in which tomorrow's teachers are being shown (or not shown) to deal with morally-laden content and/or pedagogy.

Textbook analysis is a research focus unto itself. Available methodologies, while not exhaustively explored by this author, appear to offer such quantitative techniques as measurement of text space allocated to a particular use (e.g., Chiang-Soong & Yager, 1993) and statistical analyses based on codified interpretations of illustrations and phrases (Warren, 1988). Munby (1976), who suggests such analytical categories as "mentioning," is also well worth reading.

The present undertaking seems not to fit such methodologies. Though the implications of such studies probably have some educational overlap, the question being asked is different. Tallies, codes and percentages do not get at the issue of *the message*. If we hope to understand how preservice science teachers are being trained to navigate the murky waters of moral education, we must attempt some sort of analysis of that message: Is it there in clear print? What does the print say? Is the message consistent throughout the text, or variable with the situation? Is it implied that moral education is an optional role for the science teacher, or is it portrayed as embedded in the profession? Informed selection of methods texts by science educators should include consideration of the guidance offered the developing professional in how to take a role in achieving "the much-sought end of social responsiblity" (Ramsey, 1993, p. 255).

Methods

Six methods textbooks were selected for this study using the following criteria: 1) the texts were either entirely oriented towards science methods (four of the five), or had extensive sections devoted to science methods; 2) the texts' publication dates were recent, 1986 or later; 3) the sample of texts included representatives of both elementary and secondary levels; and 4) the texts were immediately available to me while I was a graduate teaching assistant (the time during which the study was conducted). It was assumed that since the purpose of the study was to develop an

analytical method, other criteria (popularity, circulation, etc.) were not relevant.

In order to discern the moral content of the six texts (indicated by asterisks in the reference list), the indices and tables of contents of all texts were used to sample sections which might contain direct mention of moral education and/or guidance as to the role of the teacher in moral education. The result of this sampling technique was that several terms were selected as "flags" for moral content. These were: **Affective** (-growth, -education, -outcomes), **Beliefs, Conflict, Controversy** (or controversial issues), **Dilemmas, Ethics, Moral(s), Moral education,** and **Values.** Since time prevented cover-to-cover reading of all six texts, these terms emerged highly productive in a trial-and-error pilot process involving these texts *and others*. When found, such terms usually lead to portions of methods texts which referred specifically to one or both of the following:

>affective educational outcomes (citizenship behaviors, global consciousness, stewardship, etc.);

>the role of the teacher in moral education (active guide, conscious and consistent belief system, exemplary citizen, *vs.* facilitator, neutral reporter, etc.).

Indices and tables of contents were further utilized to identify certain sections which presented pedagogical guidance in teaching "controversial" subjects. Allchin (1991) argues that "ethical" issues which are particularly problematic for teachers are those which are "still being debated" in society. This criterion afforded support for an index-and-contents search for the topics AIDS and Evolution, which were assumed representative of controversies of our time. When and if these topics were located in each methods text, the text was read for specific references to the teacher's role, the nature of the subject matter, methods of presentation particular to the controversies, and/or affective outcomes to be fostered by the teacher.

Results and Analysis

The Lemlech text (1990) addressed general elementary methods, and science methods in a content-centered section. In the text, Lemlech addresses the interface between society and the curriculum. In Chapter 4 she concludes, "historically, the school has reflected middle-class values, used middle-class textbooks and tests, and employed teachers who were middle class or aspired to be. The language of the school has been middle-class" (p. 60). While the excerpt strays from the exact

focus of this paper, Lemlech's point still matters: the social strings (i.e., white, male and middle class) tied to our content as well as our hidden curricula are strong.

This book was found to favor non-judgmental values-clarification techniques, and frequently refers to the teacher's role as a non-interfering "facilitator."

> If the students do not feel that the situation is a dilemma, then the teacher chooses a new problem situation . . .Closure is not an objective, and there is no "right" answer. The goal is confrontation and the reasoning process. The teacher's role during moral education strategies is that of a facilitator, encouraging discussion and helping students learn to reason (p. 293).

Note the absence of any sentiment that the teacher's role is also to inculcate values. The "no right answers" phrase seems a clear window into Lemlech's moral stance. Any answer could be right, in other words, and it is not within the teacher's role to guide or impose. What is unclear is how the teacher may help students "learn to reason" when there are no right answers. Lemlech does not raise the possibility that within a given social context there is probably a finite *set* of right (i.e., socially acceptable) answers. Hence, it does not appear possible to her that a teacher can provide even the boundaries around the realm of right answers. Might a student in a class learn to reason and still arrive at a socially "wrong" answer (e.g., one that could land him or her in jail)? If so, is it not within the job description of that student's teacher to guide or steer him back to a place within the boundary (see Shaw, 1992)?

Lemlech unequivocally states that the teacher has no right to guide or impose a stance upon the student:

> Students should not be forced to participate in any phase of moral education. Individuals have the right to choose a personal value system or belief without harassment (p. 183)

While Lemlech pays tribute to "appropriate attitudes and skills essential for a democratic society" (p. 335), she appears inconsistent when the heat is on in a discussion of a moral dilemma. In her text, teachers seem to get encouragement about *triggering* moral response and reflection (via controversial case instruction), yet they are warned not to provide any guidance.

The second book, an elementary science methods text (Jacobsen & Bergman, 1991) came up short on all fronts. The chosen methodology failed to turn up any reference to moral education whatever. Science seemed compartmentalized, sterile and unconnected to such concerns as global warming, AIDS, ethical treatment of lab animals, etc. The only reference that could be interpreted as a desirable moral outcome to the authors dealt with extinction and the importance of a "global consciousness." However, "important tradeoffs have to be considered and made" (p. 222), is as close as we get to navigating through controversies.

The third text (Zeitler & Barufaldi, 1988) was another elementary science methods book. These authors address the interface between science curriculum and societal interests quite directly, then offer somewhat relativistic advice:

> Controversy over the teaching of certain science-related topics is not new. . . . Proponents for and against such topics . . . have exerted great influence upon school curriculum. . . .The results of [current court] actions are unclear at this time.
>
> Much traditional school curriculum is in a state of flux. [Various groups] frequently seek to bring their own values to bear in determining what is taught in the schools or presented in textbooks. You may wish to inquire about local school policies and community standards as you begin planning for teaching children science. . . . [A]dministrators may be helpful in those situations where it is unclear how much influence various value systems should or do exert over instructional approaches and content (p. 108).

America's pluralism seems to cause these authors to imply that controversy inheres in certain hot topics, that guidance (probably of a political more than a moral nature) should be sought from the nearest administrator, and that other units of science that are out of the public's influence are less morally-laden. While the direct approach in this text is refreshing, it lacks the admonitions that 1) values pervade instruction without regard to the position of public spotlights[1], and, 2) objectivity isn't as objective as we might think.

The fouth text, also an elementary methods text (Chaille & Britain, 1991) addresses instruction through a constructivist theory of learning. The authors appear to send mixed messages about developing certain moral beliefs in children.

[1] See, for example, Michael W. Apple's (1992) important article on "The text and cultural politics."

They advise teachers to use social conflict between students as a way to develop rules of conduct through role playing or puppet shows (pp. 48-50). However their specific guidelines are either social (by which is meant science content-free, as in "we can clear the way for the positive, creative social interactions that are necessary for conceptual growth and change . . . [by creating] a just and reasonable environment - one where the necessary classroom rules are clearly explained to the children" - p. 48), or individualistic (as in "acknowledge the children's feelings, encourage them to come up with their own ideas, and relate the problem to the rules generated by the children" - p. 50). Elsewhere teachers are reminded not to "foster dependence on adults" (p. 8). What is missing in this text is explicit reference to the ways science instruction can lead to moral consequences. Perhaps because constructivists appear to view the child as taking a share in curriculum design, the child is seen as captain of his own moral vessel.

The fifth text, the BSCS Innovations: The Social Consequences of Science and Technology Program (Biological Sciences Curriculum Study, 1984) teacher's manual was considered a "methods text" for the purpose of this paper, due to the similarities in purpose and intended audience. This text includes a sub-heading "Dealing With Issues and Values," found under the title "Facilitating Discussions" (pp. 8-9). The role of the teacher is portrayed as "facilitator." "Neutrality" is identified, as well. While explicit definitions of these terms would have been helpful, some indicative excerpts follow:

> This curriculum provides an opportunity for each student to discuss, interpret, and evaluate the social consequences of scientific and technological innovations in light of her or his own value system.
>
> Within the framework of neutrality, certain behaviors will aid members of the group in learning to balance factual information with feelings: . . .
>
> Ask questions that will help your students distinguish between those components of an idea or issue that can be answered through scientific research and those components that are a matter of personal or cultural values.
>
> Through unbiased questioning, help participants examine critically all views presented. . . .
>
> Respect all sincere contributions equally, regardless of whether you agree or disagree. . . .
>
> Generally, these suggestions aim at stimulating person-to-person interaction with as little direct facilitator involvement as possible. This role is important for . . . individual growth in dealing with controversial ideas and issues.

The material is full of dilemmas presented to students for thought and discussion. While neutrality is portrayed as possible (e.g., "unbiased questioning" is presented as an achievable act; "factual information" is juxtaposed against "feelings" in such a way that suggests the former is free of the influences of the latter) students *are* nevertheless encouraged to attempt to tease out the social influences upon a review of supposedly "factual" information. Moreover, it is recognized that the individual needs to deal with "controversial ideas and issues" (pp. 8-9).

The final text to receive analysis was also the one secondary science methods text reviewed. Trowbridge & Bybee (1990) provides useful bridges between science as factual content and the influence of teacher and society on the moral development of children. In the section covering ethical dilemmas (pp. 94-95), the authors have added two guidelines which fall in line with the inherently moral nature of teachers' roles. First, they suggest requiring the students to reach "a *definitive decision* with reference to the dilemma" (emphasis added). Second, they advise the teacher to "point out inconsistencies in reasoning, and more adequate resolutions to the dilemma. Be sure to let the students answer the dilemma and *justify their positions.*" Rather explicitly, then, some answers are better than others, and it is the teacher's role to guide her students.

Elsewhere in the text (notably Chapter 2: "Beginning your instructional theory," and Chapter 3: "Understanding Science and Technology") students are guided through scenarios and readings intended to elicit and examine their emerging "aims and preferences"; they are exposed to Bronowski's (1975) "the values of science turn out to be recognizably the human values . . ."; and challenged to consider the concept that science can be executed differently depending on the scientist's adopted paradigm.

Discussion of implications

Overall, the analysis indicates that methods texts are highly variable in the degree to which they confront the issue of moral education through science. Within some texts, guidelines are absent (Jacobsen & Bergman 1991). In others (notably Lemlech) certain statements appear contradicted by guidelines found elsewhere. For those educators convinced that the morally neutral path in science is a fallacious pursuit, and further, that a visible and coherent stance is the only defensible option

(see Strike, 1991, and Allchin, 1991), one text (Trowbridge & Bybee) emerges as most promising in the guidance it provides.

The elementary methods texts reviewed were variable, but ultimately all but one appear to support some form of "moral avoidance." In other words, the authors do not seem to deal directly or consistently with the role of the science teacher in moral education. This is particularly disheartening when we perceive student attitudes about science waning by the middle school years. The role of the teacher could be enhanced, not inhibited, by knowledge of the moral imperatives that inhere in science instruction. Moreover, teachers who steer through an intersection unconscious of the presence of alternative routes of travel have not, after all, made choices when many are to be had. Deliberation and reasoned decisions have not occurred.

Those texts which we might categorize in a "moral confrontation" group (BSCS and Trowbridge & Bybee) were found to convey rather consistent and proactive messages regarding the teacher's role in moral education. Clearly, some answers *are* unacceptable given the social context to which our schools are inextricably tied; some forms of reasoning *are* incomplete. Scriven's (1969) confident claim is that "we can frequently justify trying to change student values in the classroom; we can frequently justify trying to change them in a particular direction..." (p. 3, emphases his). He also describes the "empirical punch" underlying moral positions.

The wide variation among science methods texts in their approach to moral education should give cause for concern. In Strike's (1991) terms, "education of individuals in a liberal state [can] not be neutral in any broad way" (p. 432). *Hidden* moral curricula should not be viewed as *absent* moral curricula. Strike characterizes public schools as "morally chaotic and purposeless institutions" (p. 476). He attributes the failure of the public--and, we might well infer, textbook publishers--to engage in a discussion of educational philosophy to a widespread sentiment that "values are largely matters of personal preference instead of objects of social reflection," and further notes that "the educational system . . . behave[s] as though employment is central and citizenship peripheral to meaningful lives" (p. 415). Strike's observations would help us make sense of those authors/publishers whose texts exemplify society's ambivalence towards imposing values upon students. Their implicit assumption is that avoiding such impositions is possible for teachers. Such authors and publishers would do the preservice science teacher a favor were they to read--and heed--an important message: Fenstermacher's (1991) plain call for a reexamination of the "profoundly moral activity" (p. 133) we call

teaching. Science teachers are not only about making sure their students are "first in the world in science . . . achievement" (U.S. Department of Education, 1991). As Martin (1987) reminds us, they are also about educating the *person*::

> When we say someone is 'educated,' our language is especially value laden. The implication is that the person has studied worthwhile subjects, and *through them*, has acquired important qualities (p. 8, emphasis added).

Martin has more to offer in this discussion. She claims "education is not and ought not to be limited to learning *about* : there are . . . emotions to be fostered, attitudes to be developed, convictions to be encouraged, ways of acting to be promoted" (1981, p. 78, emphasis mine). Martin warns that development of the mind is "lopsided," and will result in "ivory tower people" who "see the world . . . but [do] not . . . act in the world. . . . [Such people] will be provided with knowledge about others, but will not be taught to care about their welfare, let alone . . . act kindly toward them." (pp. 53, 44).

> Just as the tobacco farmer who, when asked if he experienced any moral conflict about continuing to grow his crop in the face of massive evidence linking cigarette smoking to death, allowed that it never occurred to him to feel guilty because his primary responsibility was to make a living, the liberally educated people of the [educate-the-mind-only] theory will see themselves if all goes as planned not as mutually dependent, cooperating members of a society, but as self-sustaining atoms (p. 56).

Authors of science methods textbooks might benefit from an examination of the explicit moral guidance offered in some curriculum supplements, such as Caduto & Bruchac's Teacher's Guides to Keepers of the Earth (1988) and Keepers of the Animals (1992). In the section titled "Moral Development: An Important Consideration" (pp. 7-8), teachers are advised to "encourage children to choose and act on moral standards," while also conveying the message to the student that "this is not seen as a license to 'do his or her own thing'" (p. 8).

The Science-Technology-Society dimension in science education reform also creates an opportunity *and* imperative for clarifying the role of science teacher as moral educator. Research into science courses which capitalize on the morally explicit STS interfaces shows some promising outcomes in both achievement,

attitudes and actions of students (Yager, Tamir & Huang, 1992; Ramsey 1993). In Ramsey's words, "If social responsibility is the 'end' of the science education process then there must be an appropriate 'means'" (p. 240).

Assumptions

Because this paper concerns explicit moral content, it would seem relevant to declare the assumptions held by the author. The first is that teaching (science teaching in this case) is inherently a morally-laden act, i.e., that teachers both unknowingly and knowingly convey normative messages involving "right and wrong . . . duties and obligations" to their students (Strike, Haller, Soltis in Campbell, 1992, p. 6), and that this occurs through both the presentation of content and the general actions of the person who is the teacher (see Hansen, 1992). Second, it is assumed that an examination of textbooks (science methods texts in this case) is useful in its ability to shed some light on the teaching practices which are affected by them (Munby, 1976; Warren, 1988; Chiang-Soong & Yager 1993). The third assumption is that science textbooks themselves are morally-laden, in that their explicit (i.e., stated), implicit (i.e., implied) and null (i.e., excluded) curricula (Eisner 1985) must de facto present information through a mix of judgments as to this information (terminology, generalizations, groupings, illustrations, leading questions, media, layout). It is an author's or publisher's discretion whether and when to divulge the underlying judgments and paradigms which mingle with and/or convey "facts." The final assumption underlying this paper is also a recommendation: A text which publishes a disclosure of its own "moral content" -- one might say, uncovers its own hidden curriculum (Martin, 1976)--is more useful to that text's consumers than one which does not.

Analytical protocol

Interested members of NARST are solicited for their reactions to the analytical procedure described. Areas of criticism may include:

1. The methodology described should be applied to a larger sample of methods texts before further conclusions can be reached.

2. Authors of textbooks which receive analysis should be invited to respond to the conclusions drawn by the researcher.

3. Selection criteria for textbooks to be analyzed should be examined and, if necessary, strengthened. Methods texts with wide circulation and/or several editions might be targetted so as to get at those books most preservice teachers are reading.

4. Science methods instructors could be queried regarding their interpretations of the passages receiving analysis, and further, could be asked about their *uses* of those same sections in class.

5. The question of a topical search methodology could be problematic. Since methods texts are decidedly not content texts, references to specific science topics tend to be fewer and less predictable. If this were not the case, developing a topical taxonomy such as Piel's (cited in Chiang-Soong & Yager, 1993, p. 343) would be useful. Thus, using evolution and AIDS as representative controversies is tantamount to assuming that these will consistently be the topics selected by all methods text authors when and if they write about teaching methods for controversial-topics. However, a quick review of biology texts currently in use will reveal that a majority of them do refer to both these topics. Moreover, AIDS-related text passages are highly variable in their mix of biology content (AIDS as a virus) and social messages (AIDS as a correlate of behavioral choices).

6. In future development of an analytical technique, texts might receive placment along a "moral avoidance--moral confrontation" continuum. Placement could be assisted by clearly-worded definitions of the continuum's endpoints. A rubric similar to those employed in performance assessments might be developed by using definitive exerpts from actual texts.

7. It is acknowledged that other factors beyond methods courses and texts influence teachers' pedagogical choices. Some factors are probably more compelling than those addressed in the current study. Interested readers are advised of a relevant study by Shankar and Skoog (1993). These researchers found that at least for "red flag" issues such as the evolution - creation debate, these factors appear to include years of teaching experience, school size where a teacher teaches, the amount of science content coursework conducted by the teacher in college, and the religious convictions of the teacher.

8. The validity of equating a teacher's guide and a methods textbook for

analytical purposes needs discussion and study.

9. Some method of analyzing the consistency of the moral message is needed. Does the author appear to indicate that the teacher should act as a moral guide in some issues but not in others, for example?

10. Some method for quantification could also be warranted. Arguably it is not only the consistency of a message but its frequency which conveys the importance of the teacher in moral education.

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References(texts selected for analysis are indicated by an "*")

Allchin, D. (1991). Dissecting classroom ethics: Teaching philosophy in science. The Science Teacher 58(1), 44-49.

Apple, M.W. (1992, October). The text and cultural politics. EducationalResearcher 21(7).

Barone, T. E. (1992). On the demise of subjectivity in educational inquiry. Curriculum Inquiry 22(1).

Bebeau, M.J. (1992, April). Can ethics be taught? A look at the evidence. Paper presented at the American Educational Research Association - International Symposium. San Francisco, CA.

*Biological Sciences Curriculum Study (1984). Innovations: The social consequences of science and technology program, Teacher's Guide. Dubuque: Kendall/Hunt.

Caduto, M. J. & Bruchac, J. (1988). Teacher's guide to Keepers of the earth. Golden, CO: Fulcrum Publishing.

Caduto, M. J. & Bruchac, J. (1992). Teacher's guide to Keepers of the animals. Golden, CO: Fulcrum Publishing.

Campbell, C. E. (1992, April). Moral and ethical dilemmas in schools. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA.

*Chaille, C. & Britain, L. (1991). The young child as scientist: A constructivist approach to early childhoodscienceeducation. New York: HarperCollins Publishers.

Chiang-Soong, B. & Yager, R.E. (1993, April). The inclusion of STS material in the most frequently used secondary science textbooks in the US. Journal of Research in Science Teaching, 30(4), pp. 339-350.

Cordero, A. (1992). Science, objectivity and moral values. Science&Education 1, pp. 49-70.

Eisner, E. (1985). Theeducationalimagination. New York: Macmillan Publishing Co.

Eisner, E. (1986). Ethical tensions in qualitative research. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA, April, 1986.

Fenstermacher, G. D. (1991). Some moral considerations on teaching as a profession. In J. I. Goodlad, R. Soder, & K. A. Sirotnik (Eds.), The moral dimensions of teaching (pp. 130-151). San Francisco: Jossey-Bass.

Hansen, D. T. (1992). The moral importance of the teacher's style. Forthcoming in Journal of Curriculum Studies 24.

*Jacobsen, W. J., & Bergman, A. B. (1991). Science for children: A book for teachers, 3rd ed. Englewood Cliffs, N.J.: Prentice Hall.

*Lemlech, J. K. (1990). Curriculum and instructional methods for the elementary school. New York: Macmillan Publishing Co.

Martin, J. R. (1976). What should we do with a hidden curriculum when we find one? Curriculum Inquiry 6, pp. 135-151.

Martin, J. R. (1981). Needed: A new paradigm for liberal education. In J.F. Soltis (Ed.), Philosophy and Education, 80th Yearbook, National Society for the Study of Education, Part I. Chicago: University of Chicago Press. 37-57.

Martin, J. R. (1987, Spring). The contradiction of the educated woman. Forum for honors, 17(3), 3-20.

Martin, J. R. (1991). What should science educators do about the gender bias in science? In M. Matthews (Ed.), History, philosophy and science teaching. Toronto: OISE Press. pp. 151-166.

Martin, J. R. (1992). The schoolhome: Rethinking schools for changing families. Cambridge, MA: Harvard University Press.

Munby, A. H. (1976). Some implications of language in science education. ScienceEducation 60, pp. 115-124.

National Research Council (1990). Fulfilling the promise: Biology education in the nation's schools. Washington, D. C.: National Academy Press.

Ramsey, J. (1993, April). The science education reform movement: Implications for social responsibility. ScienceEducation 77(2), pp. 235-258.

Scriven, M., (1966). Student values as educational objectives. Publ. no. 124. West LaFayette, IN: Purdue University Press.

Shankar, G., & Skoog, G.D. (1993, April). Emphasis given evolution and creationism by Texas high school biology teachers. ScienceEducation 77(2), pp. 221-234.

Shaw, B. C. (1992, December). The legal implications of values education. Maine Policy Review, Dec. 92, pp. 37-47.

Strike, K. A. (1991). The moral role of schooling in a liberal democratic society, in G. Grant (Ed.), Review of research in education. Washington, D. C.: American Educational Research Association, pp. 413-483.

Tom, A. R. (1992). The moral responsibility of teacher educators. Paper presented at the annual meeting of the American Educational Research Association, San Francisco, CA., April 20-24.

*Trowbridge, L. W., & Bybee, R. W. (1990). Becoming a secondary school science teacher, 5th ed. Columbus: Merrill Publishing Co.

U.S. Department of Education (1991). America 2000: An education strategy. _Washington, D.C.: Author.

Warren, C. R. (1988). The use of ordinary least-squares regression in the development of an instrument to measure sexism in biology textbooks. Paper presented at the annual meeting of the Mid-west Educational Research Association, Chicago, IL., October 13.

Yager, R.E., Tamir, P., & Huang, D. (1992). An STS approach to human biology instruction affects achievement & attitudes of elementary science majors. The American Biology Teacher, 54, pp. 349-355.

*Zeitler, W. R., & Barufaldi, J. P. (1988). Elementary school science: A perspective for teachers. New York: Longman.