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ABSTRACT

The paper discusses curriculum change in American education and describes a social studies curriculum model intended to help high school students become better decision makers. The paper is presented in eight sections. Section I identifies educational programs which have been implemented in response to crisis situations. Among these are sex education, drug education, and environmental education. Section II forecasts future developments, including accelerated social change, continued technological advancement, international conflict, and changing concepts of work and leisure. Section III explains that curriculum goals should be to help students broaden social perspectives, understand consequences of decisions, understand social issues, and deal with multiple interacting variables. Section IV describes a curriculum model which is based on progression through learning stages until students reach their highest potential. Section V identifies learning activities which are part of the model. Students are involved in role playing, exposure to alternative viewpoints, debates, clarification of ideas, defending personal attitudes, and examining consequences of decisions. Section VI lists modules developed for junior and senior high school students. Section VII provides information about how the modules were field tested. The final section offers conclusions. The major conclusion is that the proposed curriculum can help students become better decision makers by emphasizing simultaneous development in intellectual and moral/ethical areas. (DE)

PREPARING FOR TOMORROW'S WORLD: AN ALTERNATIVE CURRICULUM MODEL FOR THE SECONDARY SCHOOLS

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by

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I. INTRODUCTION

Curriculum change in American education, has on several occasions, been compared to a slowly swinging pendulum. Just as a pendulum oscillates back and forth, the topics, courses, strategies, and ideas prominent at various times in the history of education often fade into the background only to return again at some later time. Sometimes these "innovations" from yesteryear appear in slightly altered form. More often than not, however, they reappear essentially unchanged.

Sometimes the recurrent motion of the slowly-swinging pendulum is altered by the noble efforts of good intentioned educators attempting to respond to current crisis situations that seem to endlessly appear. By crisis situations I refer to the following examples to help refresh your memory:

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1 Cook College, Rutgers - The State University of New Jersey and Director of the Institute for Science, Technology, and Social Science Education.

2 Associate Director, Institute for Science, Technology and Social Science Education.

Several years ago, it became apparent that experimentation with and the use of dangerous, habit-forming drugs was becoming an extremely serious problem. Education responded by requiring all students - and teachers for that matter - to participate in drug education courses. In retrospect, one can seriously question how successful we have been. Did we treat the symptom or the cause?

Among the other more recent examples of education of a "response to crisis" nature are: environmental education, energy education, sex education, and death education. Most recently, the holocaust is being promoted for inclusion in the ever expanding school curriculum. Over the years, education has responded to crisis situations which span the spectrum of scale from purely local concerns on through the national curriculum efforts in the sciences, mathematics, and other areas so prominent during the 1960's.

Today's popular movement commonly known as the "back to basics" movement exemplifies the "pendulum" idea and "response to crisis". Even a superficial glance at the history of education reveals that, at various times, the "basics" were emphasized. So today, the swing of the pendulum has returned. Moreover, this movement has gained momentum, acquiring "crisis" proportions. Who here has not heard the cries that: "Johnny can't read." "Jane can't write". "Scores on the SAT's are dropping." "Taxes are too high; cut out the frills in education."

I do not mean to discredit such noble educational efforts, nor am I attempting to minimize the important necessity for education to respond to the needs and demands of the times. It would seem to us, however, that perhaps through more adequate forward-looking educational planning, many of the crisis situations we encounter might be avoided in the first place!

Without belaboring the point, it is well known that American education has for years been criticized for not preparing youth adequately for the future. Many have argued the point, but few have articulated it as well as Marshall McLuhan when he commented that in education we are racing down a high speed superhighway - looking in a rear view mirror.

Education of the "pendulum" variety relies on the past; education of a "response to crisis" nature emphasizes, at best, the present. Effective educational planning for the future demands that we have a clear image of what we would like that future to be. Thus, the kind of educational approach which I am about to describe, looks to and prepares students for a preferred but constantly changing world—a world in which events can only be partially anticipated.

II. THE NEXT QUARTER CENTURY AND BEYOND

Why has education to date not been very effective in preparing youth for the situations they might encounter in the future? While many possible reasons might be cited, we suggest

that among the most notable include:

a. Not knowing with any degree of certainty what changes will occur.

b. The rapidly increasing rate at which change takes place.

c. Present events may or may not have a bearing on what will be in the year 2000 and beyond.

d. The methods, strategies and techniques employed in futuristics are largely unfamiliar to educational planners and decision makers.

If the above suggestions are at all reasonable, clearly, teaching which emphasizes recall of specific knowledge, facts, and subject matter is simply not sufficient nor is this type of learning long enduring. An education of this type becomes rapidly obsolete - often before the student has an opportunity to master the subject matter. I will not try to "amaze you" with the figures that show how rapidly specific information and knowledge are accumulating and for that matter, becoming outdated. Toffler (1970) has already done that most eloquently. Certain trends, events, and research can provide important clues, however, for helping us to prepare our students more adequately for tomorrow's world.

Shane (1977) summarized the views and forecasts of a distinguished international panel of educators and leaders identifying the important developments which will more than likely have a

significant impact on future events. According to this panel, the next quarter-century and beyond will bring about:

1. A continued acceleration in the rate of change.
2. Greater complexity of life because of new technological breakthroughs.
3. The end of the hydrocarbon age.
4. A need to reassess our present concepts of growth.
5. Continued crowding, over-population, and persistent food shortages.
6. Continued pressure for human equity in all areas.
7. Increased demands from less developed countries for a new economic order.
8. International disagreement and conflict.
9. Changing concepts of work and leisure.
10. Increased governmental debt and capital deficits.
11. Governance problems and threats to freedom.
12. A post-extravagant society (the good old days are gone).

Others (Schwartz, Teige, Harman, 1977, pp. 269-278), (Epstein, 1976, pp. 34-44) have developed more elaborate and detailed lists of future developments and/or crises to which present day youth will have to respond. For our purpose, however, Shane's summary is quite adequate.

Careful inspection and analysis of the above list reveals that we must cultivate the development of certain kinds of process skills in our youth. We can surmise with a reasonable degree of certainty that we must help our students to develop highly flexible and generalizable skills to cope with a rapidly changing world. More specifically, it is our contention that educators must place an emphasis on the development of problem-solving, decision-making, and a variety of analysis or critical thinking skills.

Further review and analysis of the literature in the field of futuristics (Shane, 1977). (Schwartz, Twige, Harman, 1977, pp. 269-278), (Epstein, 1976, pp. 34-44) provides additional clues as to the kinds of issues that will very likely be prominent in the year 2000 and beyond. These issues include but are not limited to:

Food allocation

Energy allocation and depletion

Advances in biomedical technology

Social unrest and conflict

Environmental quality and modification

Application of existing and emerging technologies

Mental health

Natural resource use

Transportation

Science/technology/society conflict

Land use

Underlying all of these issues are concerns for and about equity, justice, affiliation, property, life, governance, truth, law, individual rights, and so on. (Shane, 1977), (Schwartz, Teige, Harman, 1977). Clearly, then, to be considered valid, any curriculum model designed to prepare today's students for the future must necessarily include a moral/ethical dimension.

The intent here is not to identify "specifics" but rather the broad issue areas that will become prominent over the next quarter century and beyond. This perspective is useful because it serves to acquaint the curriculum developer and the student with the general context in which the student's problem-solving and decision-making skills will be applied.

III. THEORETICAL RATIONALE

We at the Institute for Science, Technology, and Social Science Education, therefore, view education for tomorrow's world as development of those skills necessary for complex problem-solving and decision-making. Moreover, because the values component has such significant ramifications, projected future issues will be, in large part, moral/ethical issues cast in a scientific, technological, and social context.

The goals of development, we believe, should contain the following components:

1. Increased skills in dealing with problems containing multiple interacting variables.

2. Increased decision-making/problem-solving skills incorporating a wider social perspective.
3. Increased critical thinking in evaluation of consequences and implications.
4. Increased knowledge of the broad issues emerging and projected for the next quarter century and beyond.

The question, then, is how to best approach the development of more complex and comprehensive problem-solving capabilities. What is the more appropriate approach, particularly in the area of values?

While there are several approaches to values education, for us the more appealing approach is the cognitive-developmental approach offered by Lawrence Kohlberg. Kohlberg's ideas stem from the philosophic tradition of Socrates, Plato, Dewey, and Piaget. The emphasis here is to help individuals grow intellectually and morally. This, we believe, is perhaps a more functional than arbitrary indoctrination of values as used in "character" or "socialization" education or taking a "values relativity" stance, typically employed in the more common values clarification approach.

According to Kohlberg, development of reasoning from childhood to adulthood is viewed as progression through a series of stepwise stages. At each successive stage, one's concerns take on a broader perspective. Stages are not skipped nor does regression occur. That is, each stage is characterized by a very different way of experiencing and interpreting those experiences.

At Kohlberg's Stage "2", for example, "right" and "wrong" is judged in terms of satisfying one's own needs and sometimes the needs of others if it is convenient to do so. Stage "3" type of reasoning centers around maintenance of approval in one's own social group. The orientation is towards conformity to group expectation. At the higher principled stages, reasoning takes into account concerns for welfare of others in a broader context, and includes concerns for human dignity, liberty, justice, and equality-- those very same principles on which our Constitution is based.

Kohlberg's cognitive moral/ethical development theory is closely linked to Piaget's intellectual development theory. Development is viewed not as mere accumulation of information, but changes in thinking capabilities—the structures of thought processes. In the course of development, higher-level thought structures are attained, extending one's social perspective and reasoning capabilities. Applying higher levels of thinking to problems result in problem solutions that have greater consistency and are more generalizable.

Typically, this developmental approach has been employed successfully in the social studies education context (Fenton, 1975) but can be readily and usefully adapted to any program in which societal issues are an important concern.

IV. THE SOCIO-SCIENTIFIC REASONING MODEL

Combining our own philosophy, ideas, and research with the theories of Piaget and Kohlberg, we have developed what we

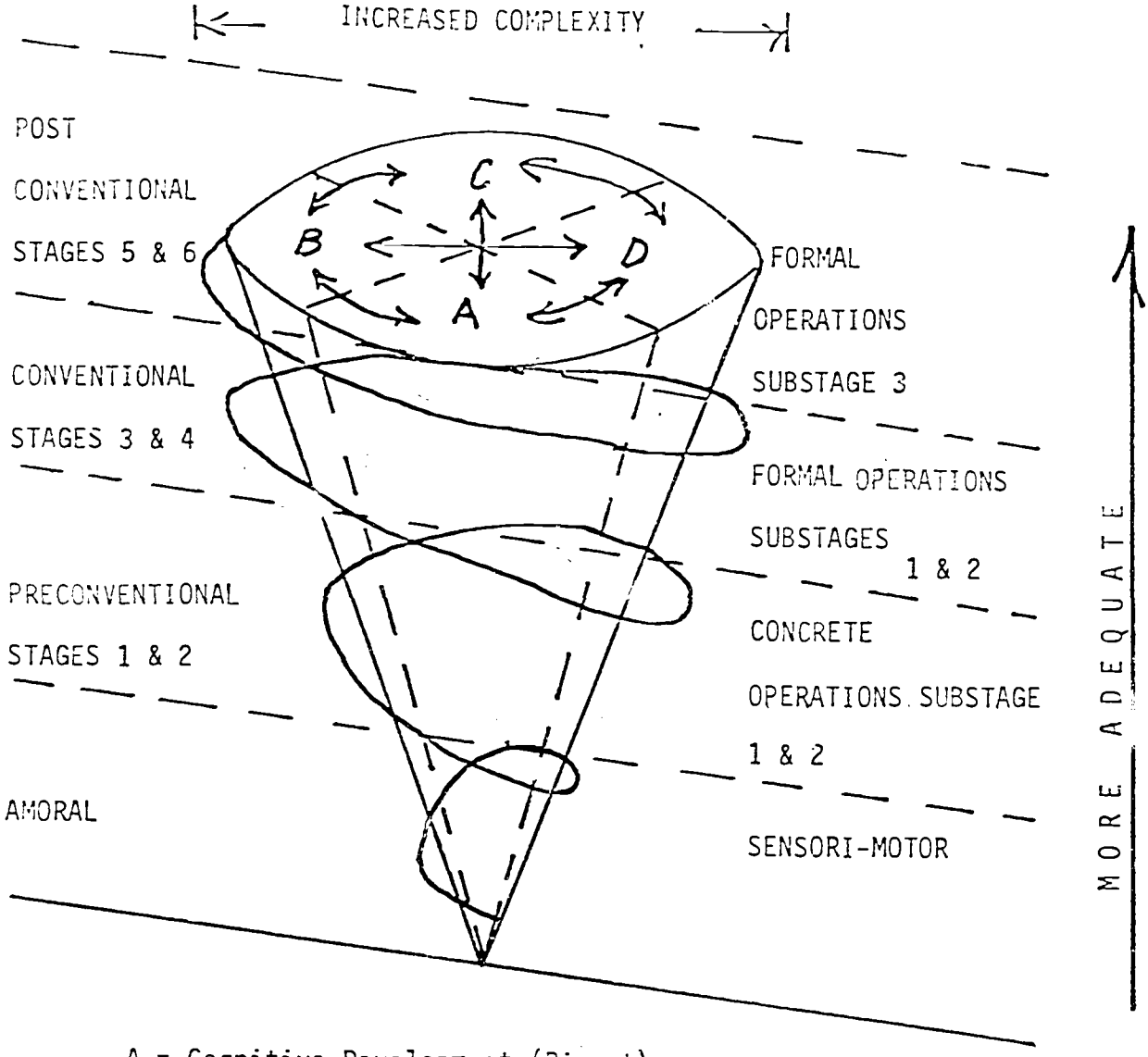
call the socio-scientific reasoning model. Socio-scientific reasoning, as we define it, is the incorporation of the hypothetico-deductive mode of problem-solving with the social and moral/ethical concerns of decision-making. This model has served as our guide in the development of a series of educational materials to help students advance to higher levels of thinking and reasoning capabilities. Moreover, it is highly flexible and readily adaptable to other curriculum development efforts.

The basic assumption of this model is that effective problem-solving requires simultaneous development in the realms of logical reasoning, moral/ethical reasoning, and critical thinking. Pure objective scientific thinking connot be applied in the resolution of most of the projected future conflicts without regard to the impact of those decisions on human needs and human goals. A technological solution, for example, may, after critical analysis, very well be feasible and logically consistent. But in light of the consequence on society, we must question whether or not it should be applied. How to best prioritize our needs and evaluate trade-offs with a concern for the needs of future generations also invloves critical thinking, but now with an added dimension—a social moral/ethical reasoning dimension.

Hence, our model consists of four interacting components (see Figure 1): cognitive development (A) is based on the theories of Piaget, while moral/ethical reasoning (B) relies heavily on Kohlberg's ideas. The aspects of critical thinking (D) upon which our model relies most heavily are generating

FIGURE 1

THE SOCIO-SCIENTIFIC REASONING MODEL



A = Cognitive Development (Piaget)

B = Moral/Ethical Reasoning (Kohlberg)

C = Knowledge (of Problem Issue)

D Critical Thinking
(1) Hypothesis Testing

(2) Judge Reliability/Adequacy of data and sources

(3) Deductive logic (if - then)

(4) Identification of valid/non valid assumptions

hypotheses, judging the reliability and the adequacy of data and data sources, deductive logic of an "if-then" nature, and the adequate identification of valid and non-valid assumptions, Since Component (C) knowledge of the problem issue, will vary, so too will the concepts vary accordingly. For example, the problem issues could deal with environmental problems, bioethics, or any other topic one chooses to investigate.

Each component of our model is not seen as a totally separate and distinct entity. Rather, each component interacts with and has an effect on all other components. Thus, cognitive development has an effect on moral/ethical reasoning. These interact with critical thinking which in turn interfaces with knowledge and all other components.

While each stage reflects a distinctly unique mental capability for problem-solving, development progresses in a continuous spiraling process. In this process there are, however, leaps and halts. Fixations at any stage is possible.

Our goal, then, is to help all students to "spiral" or progress through the stages and to achieve their "more adequate" or higher potential.

This model, then, responds to the need to stimulate upward progression. Research assessing development in Piaget's cognitive and Kohlberg's moral/ethical stages reveal that people do not advance at a consistent rate. More often than not, particularly at the upper levels, we find low rates of advancement or fixation

at a given stage. For example, research findings indicate that about 50 p cent of late adolescent and adults are formal logical thinkers, while only about 10 percent of the formal thinkers reason at Kohlberg's principled moral/ethical level (Kohlberg, 1975). These findings further suggest that although reasoning in the moral/ethical realm is dependent on cognitive development, it does not necessarily develop along in a synchronous manner (Tomilson-Keasey, et al., 1974).

V. CURRICULUM STRATEGIES TO PROMOTE UPWARD PROGRESSION

The application of our socio-scientific reasoning model centers on identifying those learning experiences important for assisting students' advancement through the stages. In addition, this model will also help curriculum developers determine the type of activities appropriate for different students at different grade levels, with different needs. Implicit in the stage theory is that at each stage there is a characteristic form of thinking capability which determines how experiences and information are interpreted and acted upon. An example of those strategies and activities which we consider appropriate for secondary school students is found in the Appendix.

The strategy underlying all of these activities is that of creating disequilibrium. According to Piaget (1970), it is only when disequilibrium is created that active restructuring of thought processes takes place, leading to movement to the next

higher stage. Restructuring occurs when internal disequilibrium is felt by the individual. That is, new experiences and inputs incomprehensible to the individual challenge his/her existing mode of thought by revealing inadequacies or inconsistencies in that problem-solving strategy. Arrestment at a given stage is partially explained by the developmental theorists as the lack of opportunities that create conflict or dissonance, which place the individual in a position where he/she needs to reassess his/her particular mode of thinking. As Clive Beck (1972) points out, perhaps the reason people do not develop morally is because they have not had the opportunity to entertain alternatives--their imaginations have not been extended.

We have indentified the following as some of the basic elements needed to provide those experiential opportunities that would promote development toward higher level reasoning. These include:

1. Exposure to alternative viewpoints
2. Taking the perspective of others
3. Examining and clarifying one's own ideas
4. Examining the consequences and implications of one's own decisions
5. Defending one's position

One educational activity incorporating these elements is the classroom dilemma discussion, an activity most commonly employed by Kohlberg and his colleagues. We have, however, modified and extended this approach to encompass more critical analysis and evaluation of information and data, as well as employed other formats such as role playing, simulations, and future forecasting and analysis methodologies.

Our approach focuses on dynamic student-to-student interaction with the idea that, within a heterogeneous classroom, there is a diversity of stage reasoning models. Through discourse students are thus exposed to divergent viewpoints and different levels of reasoning. Students taking different positions will question and challenge "why" a particular stance is held. In the course of discussion, students will reflect on their own thinking, clarify their arguments, and evaluate the adequacy of their reasons. The emphasis is not on the desirability or value of one position over the other, but the reasoning and how convincing the reasons are in support of the arguments. In a heterogeneous group, the students thus encounter higher levels or + 1 reasoning.

However, effective discussion cannot take place in a vacuum. Needed also is a knowledge base or context from which students can begin to analyze and evaluate information. With information which they have extracted and synthesized, additional ideas and rational arguments can be developed for discussion. For our curriculum materials, we have set problem situations in a variety of contexts which, according to scholars in the field

of future studies, will probably be prominent in the next quarter century and beyond. This adds another dimension to the dilemma problem, that which elicits scientific logical reasoning in addition to moral/ethical reasoning, but in a futuristic context.

Included in each curriculum module are several types of extension activities. These serve as a mechanism for students to put some of the ideas and judgments that have emanated from the discussion into a larger structural framework. They also provide students an opportunity to project into the future, thinking beyond their own immediate experiences and considering implications of different decisions on future society.

VI. CURRICULUM MATERIAL BASED ON THE SOCIO-SCIENTIFIC REASONING MODEL

The curriculum materials produced by our institute exemplify the flexibility, adaptability, and effectiveness of the socio-scientific reasoning model in curriculum development efforts. Our materials are "free standing" modules that can be used in a number of different courses in a variety of ways. This circumvents the problems often encountered when implementing new courses of study in the existing highly structured school programs. Moreover, it illustrates our belief that decision-making for the future requires a transdisciplinary approach. That is, future issues for prominence will surely impinge in nearly every subject area of study.

Typically, each module can be conducted within a 4 to 6 week period. To date, we have produced 10 modules, and by the end of the current school year, four additional modules will be available. Our modules for senior high school level are:

Dilemmas in Bioethics

Environmental Dilemmas: Critical Decisions for Society

Beacon City: A Land Use Simulation

Science, Technology, and Society: A Futuristic Perspective

The Quality of Life - New Jersey

Food - A Necessary Resource

The Rights of the Environment: A Social Dilemma

For the junior high school, we have produced:

Energy: Decisions for Today and Tomorrow

Perspectives on Transportation

Future Scenarios in Communications

Coastal Decisions: Difficult Choices

Space Encounters

Technology and Changing Life Styles

Man and Environmental Changes

The modules range on a continuum from those which are highly structured sequentially to those which contain discrete, independent activities. The modules for the lower grades tend to be more structured with subsequent activities building upon skills learned in prior activities.

All the modules, however, are related by a common thread. That is, providing meaningful experiences for students in order to stimulate an internal personal sense of conflict and to expose them to a higher level reasoning in the context of emerging

future issues. As we have indicated, this process can be effected using a variety of educational techniques, provided that they are appropriate for the unique thought structures of different cognitive levels and offer opportunities for students to reflect upon the adequacy of their own thinking. In addition, all the modules deal with existing and emerging conflict issues at the interface of science, technology, and society.

VII. ASSESSMENT OF THE SOCIO-SCIENTIFIC REASONING MODEL

Initial field tests of our first five curriculum modules involved more than 3,000 New Jersey school children in grades 7 through 12. The results of these field tests which included pre- and post-test scores and other data on both experimental and control groups indicated that exposure to our curriculum materials produced increases in knowledge content, critical thinking skills (Cornell Critical Thinking Test) and moral/ethical reasoning (Defining Issues Test, Rest, 1976; and Environmental Issues Test, Iozzi, 1976, 1978). Papers and research reports dealing with the specific results achieved, using each module tested to date, are in preparation. It is anticipated that these reports will be available for distribution by the first of the year.

Module	Knowledge	Critical Thinking	Moral/Ethical Reasoning
Beacon City: A Land Use Simulation*	X		X
Bioethics, Dilemmas in	X	X	X
Environ. Dilemmas: Critical Decisions for Society	X	X	X
Energy: Decisions for Today and Tomorrow	X	X	X
Future Scenarios in Communication	X	X	X

(* - Field test duration - 2 weeks)

X = pre-post test difference significant at .05 level or higher

VIII. CONCLUSION

The socio-scientific reasoning model which has guided our curriculum development efforts is, we believe, an effective and relevant model for educating youth for tomorrow's world. The developmental perspective offers several important dimensions in curriculum development. Emphasizing simultaneous development in the intellectual and moral/ethical realms, we can better prepare students for decision-making about present issues as well as issues projected to be of major importance in the next quarter century and beyond. Understanding the ways students deal with information at their different thinking levels, we can then develop those instructional materials that will help advance their thinking.

We are thus confident that application of this model is most appropriate for promoting one of our major goals: effectively preparing youth to function in an increasingly changing and complex world--tomorrow's world.

Summary Outline of Curriculum Criteria

Developmental Models	Characteristics of Model Revelant To Secondary School Students
PIAGET: Cognitive development is sequential, invariant stepwise stages. Change via restructuring of thought processes through assimilation and accomodation.	Transition from concrete to formal logical thought operations, proportionality operations, combinatorial operations, probability operations, logical propositional operations (implications, disjunction, compatibility, etc.) Thinking in a hypothetico-deductive manner.
KOHLBERG: Moral/ethical reasoning develops in sequential, invariant stages, advance to higher stages by resolution of disequilibrium caused by recognition of inadequacy of own reasoning.	Transition from conventional to principle level of reasoning. Decisions based on principles that have validity, consistency, & application apart from authority of groups and individuals, guided by self-chosen ethical principles & concerns for universal social justice & individual rights.
PROBLEM SOLVING, CRITICAL THINKING ... As function of development in cognitive structures & moral/ethical reasoning abilities. Leading to increased sophistication in problem solving strategies.	Problem definition emcompasses more extensive perimeters. Problem seen in wholistic fashion-ability to isolate important elements. Search for relevant information. Entertain alternatives. Eval. possible alternatives & validity of argument. Test alternatives. Eval. solution & make revision.

Institute for Science Technology & Social Studies Education (3/77)

Summary Outline of Curriculum Criteria

Curriculum Strategy - Provide Students Opportunities to:	Curriculum Activities
1. Reason hypothetically-deductively; 2. Generate possible alternatives; 3. Distinguish probable & possible events, dealing with reality and abstraction; 4. Consider consequence of alternative actions; 5. Interact directly with content of learning; 6. Integrate personal experience into greater social whole "decentration" 7. Isolate variables to test validity of proposition, controlling variables; 8. Relate ideas one to another; 9. Reflect on own thinking.	1. Projection of future possibilities; 2. Role Playing; 3. Simulations; 4. Individualized Research of Problems/Issues; 5. Case Studies from wide range & variety of matls.; 6. Active Experimentation/ Systematic Analysis; 7. Debates-Developing Logical Arguments.
1. Interact with peers at more advanced stages of reasoning; 2. Consider perspective of other persons; 3. Experience diversity of alternative ideas; 4. Consider basis of personal value system & judgment; 5. Evaluation of information, judgments, and opinions; 6. Recognize role of self & society.	1. Dilemma discussions; 2. Role Playing; 3. Communcations in small and large groups; 4. Reading & evaluating opinions & judgement of others 5. Making choices and supporting those choices; 6. Prioritizing preferences.
1. Explore problems from perspective of different disciplines; 2. Integrate ideas & concepts; understand appropriate relationships; 3. Generate hypotheses & test; 4. Consider short-range & long-range effects & implications; 5. Explore different problem solving strategies; 6. Apply appropriate methodology, recognize demands of problem; 7. Use different information sources; 8. Explore own creative ideas.	All of the above plus: 1. Problem Analysis/Synthesis 2. Divergent Questioning 3. Future Forecasting Strategies

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