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ABSTRACT

This teacher's guide was designed to be used with senior high school level classes as a supplement to existing programs in the areas of science and social studies. Each of the 12 chapters included in the guide may be used independently or may be combined into a separate course on the relationships between science, technology, and society. The separate chapters deal with: (1) technology; (2) decision making in a high-tech world; (3) genetic engineering; (4) artificial intelligence; (5) nuclear energy; (6) acid precipitation; (7) hazardous wastes in the environment; (8) food and agriculture; (9) organ transplantation; (10) transportation; (11) robotics; and (12) technology and decision making. The teacher's guide includes lesson plans, teaching tips, and student handouts and worksheets. (TW)

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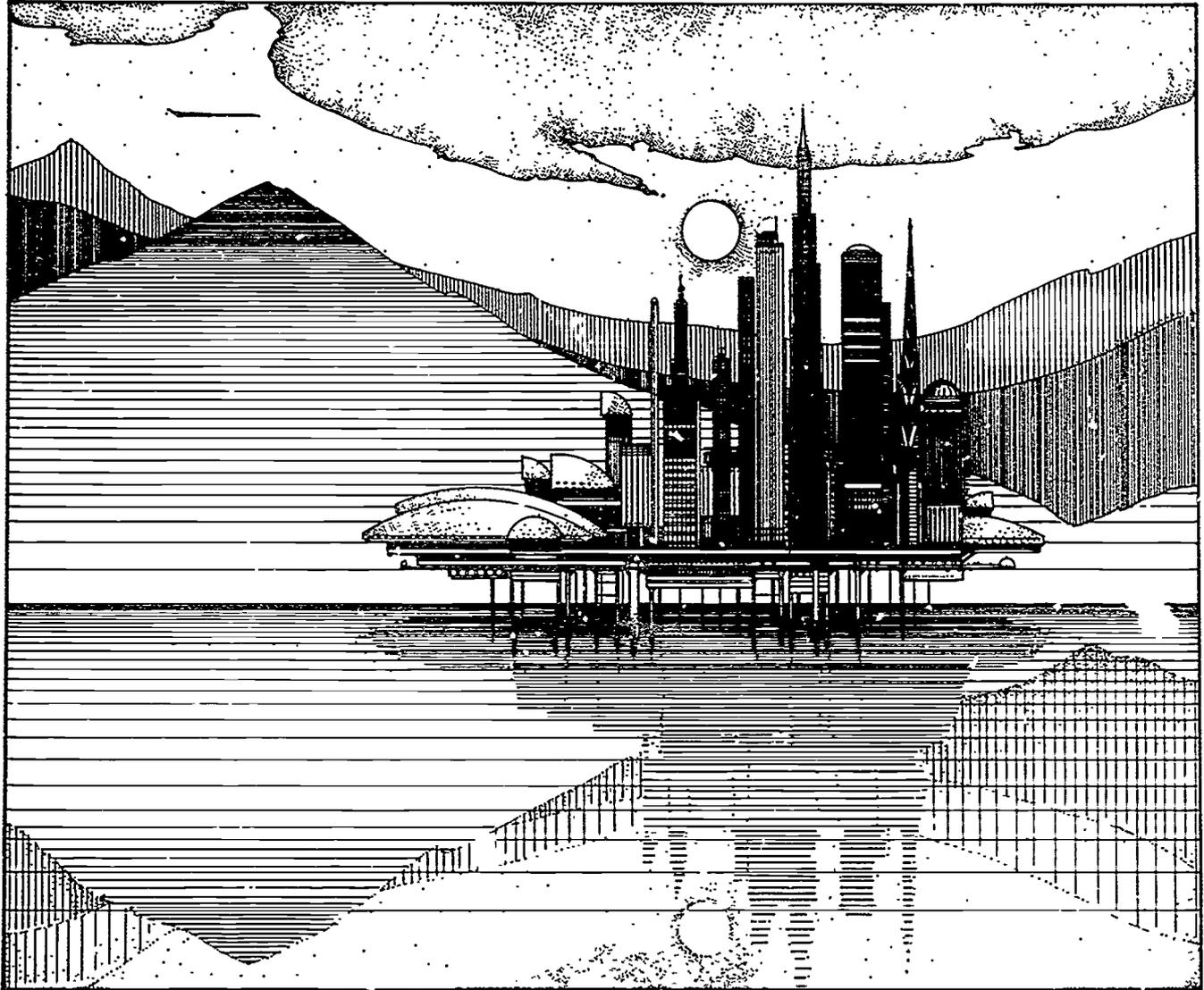
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— *for Today and Tomorrow*

TEACHING NOTES

SE 048 820

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Decisions for Today and Tomorrow:
Issues In
Science - Technology - Society

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DECISIONS FOR TODAY AND TOMORROW

Audience and Program Usage

Decisions for Today and Tomorrow: Issues in Science-Technology-Society was designed for the senior high school level (grades 9-12) as a supplement to existing programs in the areas of science and social studies education. Depending upon the students involved, the program can also be used with more capable younger students, as well as students well beyond the senior high school grades. Each of the twelve chapters included in the Student Guide is complete and independent and can, therefore, be taught or studied in any sequence selected by the teacher. This feature is particularly helpful when coordinating this supplementary program with an existing program of study. Of course, this program can stand on its own and be taught as a separate and distinct Science-Technology-Society program if so desired.

This program can be used in many ways. It could be used as a basal text for a course in S-T-S at nearly any grade level, 9 through 12. In this case, one would use the program in the same way that any other textbook is used. Hence, one would typically start with chapter one and move sequentially through the book chapter by chapter. It is not critical that the text be followed chapter by chapter in strict order. You can skip around. However, it is highly recommended that, if you want to change the order of the chapters for any reason, you first teach chapter 1 and chapter 2. You can then reorder chapters 3 through 11. Chapter 12 is best utilized as the last chapter studied, although it too, can stand on its own if necessary.

Another approach is to supplement existing courses in social studies and science by emphasizing those sections that apply directly to the course being used in the classroom and then moving more quickly - or even eliminating - those chapters that are not specifically related to the existing course of study. Still another method might be to teach the course in the way one might deal with current events in the classroom. That is, set aside one day per week to cover a current event dealing with S-T-S. One week the students could do most of the reading and in subsequent weeks they can do the activities. While this approach tends to result in somewhat of a disjointed approach, it can be effective when there is little other choice.

Highly capable students or highly motivated students enjoy using the program for science or social science enrichment. In these cases, the student(s) can work pretty much on their own with minimal help from you, the teacher. The text and activities stand on their own and work well in a variety of settings and with infinite variations. These are only a few of the typical configurations in which the program is used. There are many other arrangements as well. Use your imagination, creativity, and resourcefulness. As you come up with your own great ideas, let us know. This way we can share your ideas with others, too.

Teachers of specific disciplines (e.g., science, social studies, etc.) will probably want to elicit the discussions and activities so as to focus more heavily on the content and skills considered important to their discipline. Thus, teachers of science might want to supplement *Decisions for Today and Tomorrow* with other readings focusing on the science concerns of the issue being studied. Likewise, teachers of social studies/science might want to focus more on the social concerns by supplementing the text with additional appropriate readings or articles. Of course, all teachers should strive to relate the S-T-S issues included in the student text to the existing curriculum and regular classroom textbooks in science and social science. Another exciting, challenging, but highly rewarding, approach is to "team teach" the course in which this program is used.

Program Objectives

While the basic purpose of this program is to help students develop more mature mental structures, higher-order thinking skills, and a knowledge of present and emerging issues in S-T-S, specific objectives include the following:

- To increase student's knowledge about issues that interface science, technology, and society now and in the future.
- To increase student's ability to analyze issues that arise in our technological society.
- To increase the socio-scientific reasoning ability of students.
- To develop student's higher-order thinking skills, including problem-solving, decision-making, and critical analysis/thinking.
- To develop student's awareness of his/her role in the process of technological change.
- To help students recognize the complexity of decision-making in our high-tech world.
- To provide opportunities for students to examine possible future technologies brought about by advances in science, engineering, and societal changes.
- To increase student's ability to communicate more effectively orally and in writing.
- To increase student's ability to develop and present effective arguments in a logical, consistent, and comprehensive manner.
- To increase student's ability to read analytically and critically.

Program Materials

Decisions for Today and Tomorrow is comprised of three parts.

The **Science-Technology-Society Teacher's Guide** provides an overview of the program, a description of the model upon which the curriculum was developed and a discussion of the teaching strategies and activities utilized in the program. It is essential that the teacher be familiar with the contents of this publication in order to adequately implement *Decisions for Today and Tomorrow*.

The **Student Guide** contains the program readings and activity directions for each of the twelve "Decisions" units. The Guide is non-consumable and should be made available to each student.

Teaching Notes contains specific teaching directions and/or suggestions for each of the twelve chapters. At the end of each chapter, master copies of student handouts are provided for the teacher's use. These should be duplicated for distribution to students.

TEACHING NOTES

Chapter 1. What Is Technology?

1. Have the students read the *Introduction*.
2. Lead a class discussion of the questions presented in the Student Guide (e.g., What does the age of technology mean?).

At this point, simply have the students express themselves and their ideas. There is no need to correct false ideas or perceptions since answers to all of the questions posed in this section will be fully explored in the next chapter.

3. Make sufficient copies of the *Technology Inventory* (Handout 1) for your class.

A "master" copy, which should be duplicated, appears at the end of this section. You will need at least one copy of the inventory per student for this part of the activity and a second copy for each student for Part B of the activity.

4. Have the students read *New Technology: Mass Production* and complete the Technology Inventory.

The reading should provide sufficient information to enable the students to complete the Technology Inventory. Students may find it helpful to read through this article twice - the first time to get an overall understanding about mass production, and the second time to read for detail. You might also find it helpful to discuss the article with the class after the first reading to ensure that the students understand the major ideas before going on to read for detail.

To complete the activity, students will have to think about what they read and then **analyze and apply** that knowledge. For the most part, the students will not be able to simply "lift" the information from the reading and "plug it into" the chart. Thus, some students might need help thinking through the reading. Provide assistance and guidance as you feel it is necessary. However, be careful not to provide too much guidance. This activity was designed to make students think and, therefore, the reading was deliberately written to promote analytical thinking skill development.

Encourage the students to include as many ideas as they can possibly conjure. What at first glance appears to be insignificant may, from a long-term perspective, have profound effects.

5. Review *Activity Part A* with your students.

For the most part, the students have given little thought to the societal and institutional changes brought about by a new technology and may find the assignment confusing. A detailed review of the example given will help to clarify their questions.

Reproduce the chart on the board or overhead transparency and fill in the boxes with the students. The items for the categories *Resource Requirements and Consequences* have not been delineated and will need to be extracted from the narrative section of the example. As you progress through the example, students will inevitably begin to offer their own suggestions and discover that the task is not as formidable as they might have originally believed.

6. Have the students complete a Technology Inventory for one of the technologies listed in *Part B - Other Technologies*.

Each student will need a second copy of the Technology Inventory. Since the list of technologies is short, if there are other technologies that students wish to examine, they should feel free to substitute.

Allow approximately one class period for the students to complete their charts, or have them complete the chart as a homework assignment. In either case, the students will need sufficient time to think about many interactions that may not, at first, be obvious.

An alternative to having the students complete the chart individually is to have pairs or small groups of students complete a single chart. In small groups, the brainstorming technique is a useful one to initiate the development of ideas. In brainstorming, each item is considered in turn. In a round robin fashion each student will present an idea. Each idea is recorded, and the process of presenting an idea continues until all ideas seem to be exhausted. During this initial process, the students should not attempt to evaluate the ideas presented. All ideas should be accepted and added to the list as stated. As a second step, the group as a whole will then evaluate the ideas and select those to be included. In some instances, several ideas may be combined to form a major concept.

The students may need to be reassured that there are no single "right" answers to this exercise. Depending upon an individual's earlier experiences or perspectives, one person's view about a given technology may be very different from that of another person. Try to help the students explore the ramifications of the technology by asking pertinent questions when it appears that an impasse has been reached.

7. After the charts are complete, have the students meet in small groups to share their results.

In the process of sharing ideas, new ideas will emerge, some of which the students may wish to include in their charts. The questions at the end of *Part B* should be discussed in the groups.

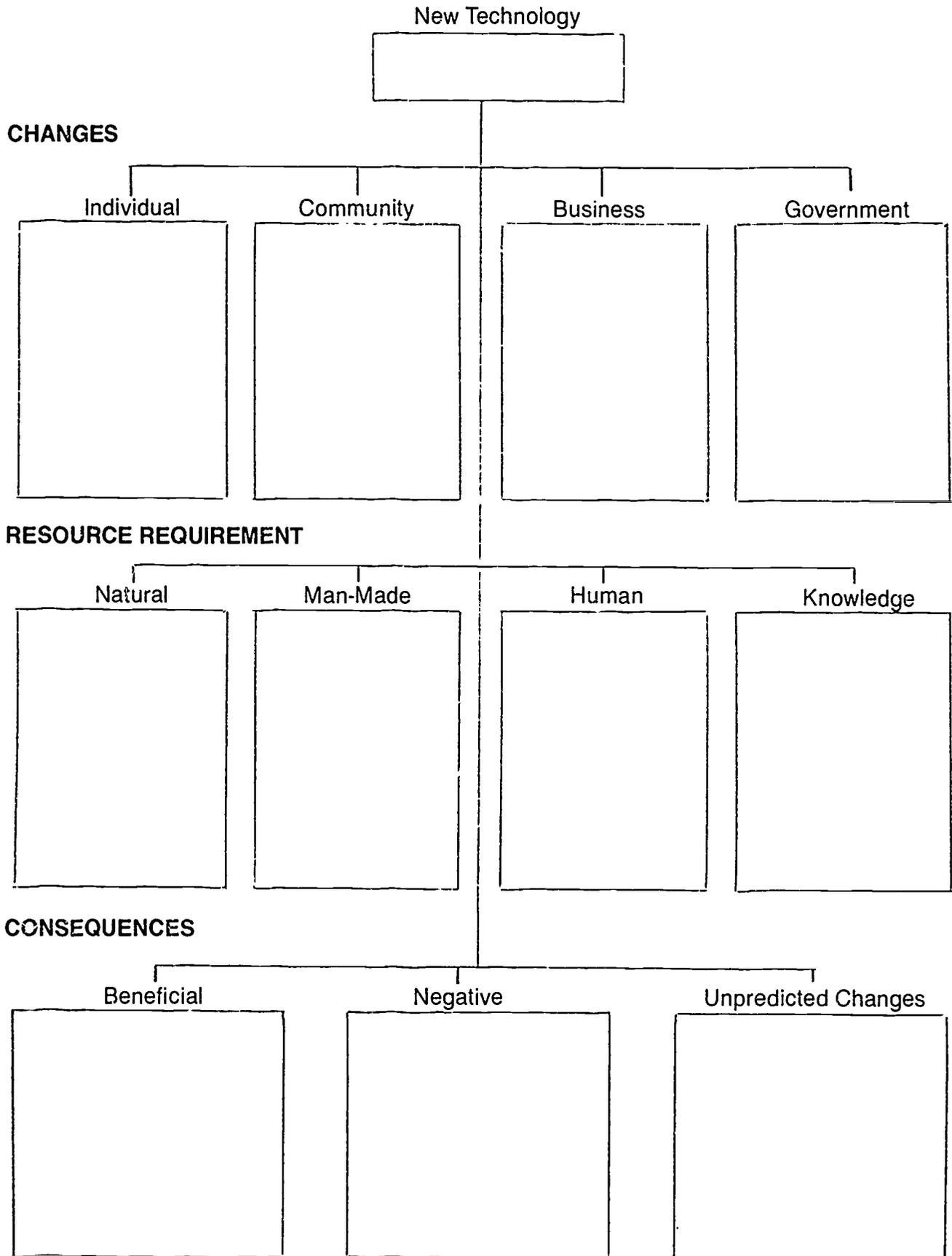
8. Have representatives from each group present a summary report of group's proceedings to the entire class since most students will want to hear the topics discussed in the other groups.
9. Summarize the activity results with the class.

Do not neglect to fully discuss the questions since they are important for helping the students develop various thinking skills. The last question "*What is your definition of technology?*" is particularly important since it is a logical "lead in" to the next section which defines what technology is all about.

10. Read and Discuss *What is Technology? A Definition*.

As with all of the readings in this text, it is important to spend some time in discussing the important points and ideas presented. This is the time to clarify and/or correct any misconceptions. This reading is particularly important because it defines what technology is and sets the stage for the ensuing chapters. The reading is very comprehensive and merits the time necessary to ensure that the students have a good grasp of the information presented.

Student Handout 1
TECHNOLOGY INVENTORY



Chapter 2. Decision Making In a High-Tech World

1. Have the students read and discuss the *General Decision-Making Model*.

You may find it helpful to make an overhead transparency of the model illustrated in the text-book and keep it projected while you go over the various steps in the model.

The students should have little difficulty in understanding what is meant in Step 1, *Define the Problem* or in Step 2, *Identify Alternatives*. They may, however, need help with the third step, *Quantify Alternatives*. You may need to explore with the students what is meant by the terms risk, benefits, and risk/benefit analysis. They may also need help in understanding what is meant by long- and short-term risks and benefits.

In discussing *Apply Decision Aids*, the fourth step in the model, you may want to discuss "judgment" and perhaps how "good" judgment is developed. Your discussion of *Decision Trees* and the *Decision Matrix* need not now be very elaborate. These tools will be discussed in detail in the next section. Similarly, since other aids (models, gaming, and simulation) won't be used until later chapters, they should be discussed only briefly at this time. Understanding steps 5 and 6 (*Decision and Implement*) should present little difficulty for the students.

It is most useful to compare and contrast the model with the "Scientific Method". You might explore the following:

- How are they similar? Different?
 - Could you substitute one for the other? Why? Why not?
2. After you have fully discussed the *Decision Making Model*, construct an activity which will give students experience in using the model.

You could suggest several problems from school or other real-life situations or have the students themselves suggest problem situations; for example,

- decide which college to attend,
which automobile to purchase, or
which courses to take in school.

The only decision aids used at this point will be previous knowledge about the issue and hopefully, good analysis and reasoning. Do not go into a lengthy discussion of decision trees or decision matrices until they are introduced later in this chapter.

Depending on the class, you might first want to "walk them" through one or two problems before they work on their own.

After the students have had an opportunity to work out some problems independently, have them compare their results.

- Were the decisions made by various individuals the same? Different? Why?
- Which appeared to be a "better" resolution of the problem situation? Why?

Important: Keep some of these problems (and the decisions made) for review at the conclusion of this chapter when students will work on some of the same problems using the decision tree and/or the decision matrix. Students will then see more easily if their decisions are any different when using these additional aids.

3. Have the students read *The Decision Tree* and discuss its process.

In discussing the decision tree and later, the decision matrix, make sure that the students understand that these are not stand-alone decision making models. Rather, they are decision-making aids that can be employed as part of step 4 in our decision-making model.

Read through the procedure once or twice. It is doubtful that the students will understand the process well enough to use it with any degree of accuracy at this point. Don't spend too much time on the procedure, but simply guide the students carefully through the example. It is usually after this part of the activity has been completed that the students begin to see what the steps in the procedure really mean.

If you feel that the students are capable of dealing with this activity effectively on their own, by all means use your own professional judgment. Spend as much time on the example and analyzing/reviewing the completed sample decision tree, as necessary.

4. Have the students use the decision tree to solve the previously defined problems, particularly those types of problems that can be broken down into a choice between two actions or choices. Again, use real-life problems, school problems, etc.

Important Note: It might seem strange that the sample problem in the Student Guide does not deal specifically with a science-technology-society related problem. This was done deliberately. To develop good thinking skills, students need to acquire experiences dealing with different types of real-life problem solving. Through the application of learned strategies to new and different situations, more effective and meaningful thinking skill development is promoted. Later, students will be provided with opportunities to solve problems created at the interface of science, technology, and society.

5. Have the students read *The Decision Matrix* and discuss its process.

In dealing with the decision matrix, you should again walk the students through the problem and show how the calculations are made. All of the steps, including the calculations, are fully illustrated in the student textbook. However, some students might still have difficulty in following the example. Make sure that every student understands each step in the process before going on. Also, be sure that the students understand that the "best" course of action when using the decision matrix is the one with the **Highest** number and not, as with the decision tree, the **Lowest** number.

6. Provide the students with ample opportunities to apply the decision matrix to solving other problems.

This extension is critical if the students are to understand the techniques (decision aid use) and be able to apply them towards solving other problems.

Make as many copies of the Decision Matrix (Handout 2) as you will need for your class. A master copy of this chart appears on the next page of this guide.

Student Handout 2: A Decision Making Matrix Form

The form is a decision-making matrix. It consists of a grid with 9 columns and 9 rows. The top-left cell is a square divided by a diagonal line from the top-left to the bottom-right. The upper triangle of this square is labeled "Selection Criteria" and the lower triangle is labeled "Weighting Factor". The first row of the grid is labeled "Alternatives" in the first column. The last column of the grid is labeled "Sum". The remaining cells in the grid are empty, with diagonal lines drawn in each cell from the top-left to the bottom-right, indicating where to enter data.

Selection Criteria / Weighting Factor									
Alternatives									Sum

Chapter 3. Biotechnology--Genetic Engineering

1. Have the students read *Genes and New Life Forms*.

This reading deals with a very complex topic. It is important for you to review any scientific terms and/or concepts used in the reading with which the students are unfamiliar (some of the terms that might be new to your students have been defined parenthetically in the text).

At many points throughout the reading the student is presented with important questions. When the students encounter the questions, they should be encouraged to interrupt their reading and respond to them at that time. To help "encourage" the students to not skip over the questions, you can require them to briefly write out their responses. In addition, all of the questions in the readings should be discussed in class at a convenient time. Other types of questions included later in the text require the student to analyze a point of view or problem and then express an opinion. Those questions should also be explored fully in class.

Of course, a full discussion of the article (including the questions) should be conducted *after* the students have carefully read the entire article.

2. Have students read *The Tulelake Story* and respond in writing to the questions at the end of the reading.

The responses should be collected and stored for later comparison with the responses derived when the activities *You be the Judge - Parts A and B* are completed. The quality of the students' written work should be held to the highest standards possible - even their responses to the questions. This is important for a variety of reasons which are discussed in the *Teacher's Guide*. (See the section on writing skill development.)

3. Complete the activity *You be the Judge - Part A*.

The instructions for this activity are quite simple. The basic question is "Should an injunction be issued to stop the experiment?" The students should follow the decision tree procedures detailed in Chapter 2. If necessary, review the procedures with the class again before they do this activity.

4. Complete the activity *You be the Judge - Part B*.

Use a decision matrix (Handout 2) to help decide who should regulate and monitor the field of biotechnology. Students should use the information provided in the readings to "extract" the alternatives and the selection criteria. While this is not a simple task, it should be well within the capability of most students. Of course, you can assist those students that require additional help as necessary.

Chapter 4. Computer Technology - Artificial Intelligence

1. Have the students read *Smart Machines. Can Computers Make the Human Brain Obsolete?*

Throughout the reading, several questions are posed for the students to answer. Encourage them to take the time to ponder the questions before continuing with the reading. Also, plan to provide ample time in class for a lively discussion of these questions and any others you feel are important.

"If-Then" statements, as they relate to artificial intelligence, are discussed. The students are asked to develop "if-then" rules for a variety of problems. This type of activity helps students gain useful insights into this important aspect of Artificial Intelligence and, at the same time, promotes the development of higher-order thinking skills.

Interest in "expert systems" and the various opportunities this approach offers is increasing daily. The students are asked to speculate why this might be so. Probably the best answer/reason is commercial value. Simply, much money can be made if these types of Artificial Intelligence programs "catch on".

The students are asked to "try writing down everything a child has to do to stack up 3 blocks into a little tower" (see Student Guide for full instructions). Make every effort to have the class conduct this activity and then have them read their procedures to the class. Discuss with the class the problems they encountered in trying to write out the program (instructions). What difficulties did they experience? How did they overcome them? Did they overcome them? If time permits, have the students try to write "programs" for various other simple (apparently) tasks.

2. Conduct the *Delphi Survey* activity

Comprehensive instructions for this activity are included in the Student Guide. Duplicate *What Are Your Future Forecasts?* (Handout 3) for distribution to your students.

3. Conduct Activity 11 *Create the Future*.

This scenario-writing activity is fully explained in the Student Guide. For general information on scenario writing, see the accompanying *Teacher's Guide*.

Student Handout 3: What Are Your Future Forecasts?

	In Your Opinion How Desirable is This?				When Do You Think This Will Occur?						What Are Some of the Effects?	Explain Why You Came to This Conclusion
	very desirable	desirable	neutral	not desirable	1990 - 2000	2001 - 2010	2011 - 2020	beyond 2020	never			
ADVANCES IN COMPUTERS												
1. Computers will understand human speech & respond to spoken instructions.												
2. Computers will learn from experience & correct their own mistakes.												
3. Computers will perform thinking and planning tasks.												
4. Computers will operate motor vehicles, trains, subways & ships without need of human operators.												
FUTURE CHANGES												
1. Every household will have a computer.												
2. Nearly everyone will know how to program a computer.												
3. Most courses in schools will be taught by computers.												
4. We will use computers to decide where to live, who to marry, what job to take, how to spend money.												
5. If one wants information about another person, one can obtain it from a computer data bank.												
6. With computerized banking & exchange of money electronically, cash will not be needed.												
7. A majority of people will spend most of the day at home.												

Chapter 5. Energy - Nuclear Power

8

1. Have students read a transcript from a Smithville Town Meeting. *The Smithville Decision*.

This reading gives the students an opportunity to assume roles as Smithville residents and attempt to come to a decision about whether or not to permit the construction of a nuclear power plant in their community. The arguments are presented in the form a transcript of a town meeting.

The students should first read the transcript silently and then, if you like, the script can be presented as a dramatization with students playing the various roles. If you decide not to conduct this activity as a dramatization, the various "parts" can be simply read aloud - each part read by a different student, or just have the students read the article a second time to ensure their understanding.

2. After the students complete the reading, they should form into small groups of from 3 to 5 students each to discuss and evaluate the different arguments that are presented in the transcript.

Distribute a copy of the *Argument Summary Sheet* (Handout 4). A master copy which can be duplicated appears on the next page of this guide. The worksheet will help the students to logically sort their thoughts and arguments.

3. The class will then reconvene as a group to hear the various reasons selected and the decisions of each group.

The presentations should be limited to about 5 minutes in length. At the conclusion of the class discussion, each student will then cast his/her vote on the proposal. To avoid the possibility of "stronger willed" students trying to pressure other students to vote "their way", it is suggested that the vote be conducted as a secret ballot.

The first part of this activity is completed with a discussion of the questions at the end of the section. While conducting this discussion, keep in mind the various suggestions made in the *Teacher's Guide* regarding classroom discussions.

4. Have the students read *Smithville Today*.

This second reading provides additional background information for the activity *The Governor's Decision*, and should be read prior to conducting a class discussion. This script can also be acted out by members of the class or simply read to acquire an information base upon which the students can call when discussing the scenario later in this activity.

It is interesting to note that recent studies indicate that growth in mental structures and reasoning occurs to an even greater extent when students are involved in "acting out" scenarios as in role play or creative drama activities, than when they simply read and then discuss the scenario. Significant growth still occurs when using this latter strategy, however, not to the same degree as it occurs in the former.

5. Conduct the activity, *The Governor's Decision*.

Use the same strategies and techniques discussed above and the suggestions presented previously in the *Teacher's Guide* (Conducting Classroom Discussions).

6. Conduct the activity *Technology, Consequences and Responsibilities*.

In conducting this activity, the students should complete Handout 5 while in small groups. A master copy of the handout appears at the end of this section.

The handout includes a series of six technologies and for each technology an undesirable effect is indicated. The students are to consider the types of new responsibilities that people must assume when they use the technology and list the responsibilities under the appropriate column. They will then suggest a solution that averts or remedies the undesirable effect.

When the small groups have completed the assignment, the class should then meet as a large group. At that time, a spokesperson from each of the small groups should report the group's decision/conclusion to the entire class. Following the presentations, the class should compare and contrast the different reports and discuss some of the more important issues that emerged. The questions at the end of the activity can serve to stimulate further discussion. Again, see the notes and suggestions regarding "Conducting Classroom Discussions" in the *Teacher's Guide*.

Student Handout 4: Argument Summary Sheet

1. In a summary form list the arguments "for" and "against" allowing the nuclear generating plant to be built in the area (e.g., FOR—need for electricity; AGAINST—change natural environment)
2. According to your opinion, how important is each reason? Indicate the level of importance with a number from 1 to 4 in the "importance" column.

- 4 - most important
- 3 - much importance
- 2 - some importance
- 1 - no importance

FOR	Import- ance	AGAINST	Import- ance

Student Handout 5
Technology, Consequences, and Responsibilities

TECHNOLOGICAL INNOVATION	AN UNDESIRABLE EFFECT	NEW RESPONSIBILITIES FOR PEOPLE	POSSIBLE SOLUTIONS
Plastics	Production of plastics create toxic waste products that are difficult to safely dispose of.		
Automobiles	Car exhaust fumes create smog which causes lung diseases and even death.		
Weather modification such as cloud seeding and hurricane control	Hurricanes are diverted from one's own country and sent over another country (perhaps to an unfriendly neighbor?).		
Television	Alters the way that political campaigns are run and propels "media" candidates		
Sonar	Enables fishermen to locate large schools of fish. This may lead to the depletion of oceanic food supplies.		

Chapter 6. Environment - Acid Precipitation

1. Have the students read *A Growing Problem*.

A variety of questions have been included throughout the reading to help students think about and process the information presented. It is important, as was the case in all previous chapters, to provide sufficient opportunities and time for the students to study and to discuss these questions. This helps the students to focus on the issues presented and fosters the development of a variety of thinking skills.

The pH chart included in the student textbook can be used to compare and contrast pH levels in various parts of the United States. An effective way to initiate a lively discussion on the topic is to begin with the questions that accompany the chart.

2. Conduct the scenario activity *Acid Lakes and Jobs*.

After the students read the scenario "Acid Lakes and Jobs", they should discuss the main question:

Should Governor Jones order the companies to burn low sulfur coal? Or, should he allow them to continue to burn high sulfur coal?

After surveying the opinions of the class regarding this question, and some of their reasons for their opinions, organize the class into several groups of 3-5 students each. Ask each group to discuss the questions again and to identify the most important reason and the second most important reason why Governor Jones should take that action.

When the groups arrive at their answer, reassemble the entire class and ask each group to report its results to the class.

An Evaluation of Possible Effects

Again form the class into several groups of 3-5 students. Duplicate copies of Handout 6 "An Evaluation of Possible Effects". A master copy of this form appears at the end of this section.

The groups should follow the instructions in the Student Guide to complete the Handout. While completing the form, they should consider the question in the text that follows the scenario "Acid Lakes and Jobs".

Discuss the results of this activity as suggested in the Student Guide.

3. Conduct the role-play simulation *Amending the Clean Air Act*.

In this activity, the students will simulate a Senate Committee conducting a hearing on a bill concerning acid precipitation. Seven students will represent Senators while the remaining students will represent one of the six special interest groups. Each group will make a formal presentation to the Senators, when the presentations are completed, the Senators will cast their votes and announce the results.

Students can be assigned to roles by self-selection or by teacher assignment. Either method offers advantages and disadvantages. You know your own class best, so use the approach that appeals to you. The idea point is to group the class so that a dynamic interchange of ideas will be produced. For more information on grouping, see the section of the *Teacher's Guide* on "Classroom Discussion" and grouping.

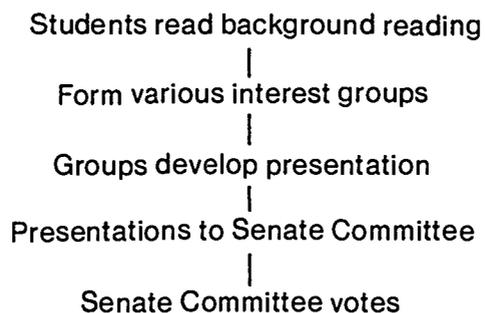
Provide ample time for the students to study their role positions. Through careful review of the background information, they can identify the major arguments associated with the position they will portray. Moreover, the students should have at least one class period or more to identify the major issues and develop their presentations. Additional research by students will enhance their learning experiences and provide other ideas for the debate.

The Fact Sheet (Handout 7) (a master copy appears on the next page of this guide) should be used by members of the interest group to aid in the development of their presentation. The Senators will use Handout 8 (master copy also included in this guide) at the hearing to help them organize their notes and comments on each group.

Upon completion of the hearing, the senators will meet to determine the outcome of the hearings. Each vote is to be accompanied by a short rationale statement. The Chairperson announces the decision and explains the reasons of the Senators.

The following gives an overview of the simulation schematically:

Simulation Overview



Student Handout 6

AN EVALUATION OF POSSIBLE EFFECTS
THE SOIL AND WATER IN PARKLANDS BECOME MORE ACID

Immediate Consequence.	Harm	Future Consequences	Harm
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	
6.		6.	

THE GLASS COMPANIES CLOSE DOWN, AND
POWER PLANTS BURN LOW SULFUR & COAL

Immediate Consequences	Harm	Future Consequences	Harm
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	
6.		6.	

Student Handout 7

INTEREST GROUP: FACT SHEET TO DEVELOP ARGUMENTS

Argument	Reasons and Benefits	Supporting Facts	Possible Opposing Arguments	Response to Arguments

1) List your arguments logically and precisely; 2) Make sure Reasons & Benefits justify your arguments; 3) Be sure to include supporting facts and materials to support your argument; 4) Anticipate possible objection or opposing statement to your argument and be prepared to defend your position.

Student Handout 8
SENATOR'S WORKSHEET

Interest Group Name	Argument	Facts Presented	Benefits to My State	Disadvantages to My State	Questions to Ask

1) Fill in the columns as the arguments are presented by the various interest groups; 2) Write down any question you may wish to ask the spokesperson; do not interrupt his/her presentation. Ask your questions at the end of the presentation.

Chapter 7. Environment - Hazardous Wastes

1. Have the students read *Hazardous Wastes*.

Provide opportunities for the students to respond to the questions posed in the reading. Students are given feedback on their answers at various points later in the reading. While scientific terms are explained parenthetically in the text, you may need to provide additional explanation/examples for some classes.

Relate Paracelsus' statement regarding "dose" being the prime difference between "a poison and a remedy" to the use of drugs. A discussion of drug abuse is very appropriate at this point. For instance, you might discuss how the proper use of drugs can lead to the misuse of drugs.

Early in the reading, the idea of risk/benefit comes up again. This will happen several times throughout the text. That is, new ideas and concepts will keep appearing in **different contexts** as the student goes through the program. This was done intentionally to help foster the development of thinking skills by applying similar strategies to different situations and conditions. At this time, it might be useful to refer the students back to previous chapters in which a risk/ benefit ratio was used (e.g., Chapter 2).

It would be most helpful to have a few copies of *Silent Spring* available for the students to read in conjunction with this chapter. An "extra credit" assignment can be developed using this classic book. It is readily available in paperback in most bookstores.

When discussing the chemical structures of the various organic compounds, use your own judgment about the amount of detail you include. The text provides enough information for the students to understand the concept and the problems. You can, however, go into as much detail and structural analysis as you like or as time permits. Allow sufficient time for analyzing the data presented. A considerable amount of information is packed into the tables and graphs.

2. Have the students read *Everybody's Problem* and have the class discuss the questions posed at the end of the reading.
3. Conduct the activity *Harry Carter's Grain Company*.

This scenario is presented in several parts. Make sure the students understand the problem or dilemma as well as the various facts that impact on the problem. Follow the procedures outlined in the *Teacher's Guide*.

The problem described in this scenario can also be addressed using a decision tree. If you decided to use this approach, try the procedure outlined above first, then use the decision tree and then compare the results. Were the results similar? Different? Why? If time will not permit the use of both approaches, try having half the class deal with the scenario in a dilemma/discussion format and half the class use the decision tree format. Then you can compare the results of the two groups.

4. Conduct the activity *Can Society Really Help?*

Comprehensive instructions for this "formal debate" activity are provided in the *Teacher's Guide* (see *Debates*). Be sure to provide the students with the debate pointers given at the end of this section in their texts. If you feel it necessary, duplicate any or all of the instruction for a formal debate and "debate pointers" for distribution to your students.

Background information obtained from reading this and other chapters is used to illustrate the

point that technology is advancing well beyond the level of understanding of much of society.

It is very important to spend a sufficient amount of time fully explaining the questions presented under *Concluding Observations* in order to tie together a lot of "loose ends". You can have the entire class deal with each question individually, have small groups of students work on one question each, or use any other configuration that you choose.

Chapter 8. Food and Agriculture

This chapter requires the student to extract information from tables, analyze the data in several ways and from a variety of perspectives, and then synthesize the information in a creative writing activity.

1. Have students read *Forecasting the Future*.

In this brief reading students are introduced to some basic forecasting concepts and terms. In addition, students read about three important forecasts for the future. Interestingly, each forecast depicts a very different scenario for the future. Some are optimistic while others are somewhat pessimistic. The students are then asked to consider several questions that guide them towards systematically examining why the forecasts that presumably are based on the same data bases suggest very different futures.

2. Have the students examine the data from the *Cornucopia Project*.

This data details trends in the area of food and agriculture. In responding to some of the questions about the Cornucopia data posed in *Whats Happening to Farming*, students will be required to extract and analyze data from the table. That is, the student will not be able to read the answer to the questions directly from the Table. Rather, he/she will be required to calculate the correct answers. Your guidance in extracting the necessary data and performing the appropriate calculations will be most important here. In **All** cases, the answers to the questions can be

- read directly from the table,
- derived by making the necessary calculations using data provided in the table, or
- derived by extrapolating data provided in the table.

At the end of each section the student is required to make a *Summary Statement* describing the meaning of the information they have uncovered. Since these summaries will be used at the end of the chapter to complete Activity B, make sure that the students arrive at justifiable conclusions and make accurate/reasonable summary statements. It is useful to collect and critique each of the summary statements and then return them to the students for necessary, "reconsideration", revision, and/or correction.

3. Have students complete the *Cost of Farming Activity*.

This activity is very similar to Activity A in format except that the information presented is interspersed with questions (and summary statements). Again, make sure that the students use the data provided correctly and prepare justifiable Summary Statements.

4. Conduct the summary activity *Averting Future Food Shortages*.

This activity is most important because it requires the student to draw together all of the information and data gathered previously and use it to develop a comprehensive plan to prevent or avert future food shortages. The procedure used is quite simple and straightforward. However, your guidance will be particularly needed in helping the students to get started. From then on, your major concern will be organizing the class activity. You might have the students work in small groups after each student develops his/her own plan of attack.

5. Have the students read "*Farming Is Who I Am*".

This reading adds another dimension to the problems addressed in this chapter. Whereas the first part of the chapter was rather factual and "data" oriented, this reading adds the "human

element" and illustrates how the personal lives of farmers are being impacted by "hard times". After reading this section, you might want to discuss the plight of the U.S. farmer. Perhaps some of your students live on farms or know farmers personally. Do they agree with the farmer portrayed in this reading? Why? Why not? Using the information and data collected in conjunction with the first part of this chapter, the students might be able to suggest ways to help the farmer. Continue the discussion of this section as long as it appears to be useful.

6. Have the Students read *The Agricultural Mechanization Controversy*.

This is a real-life case study that discusses a frequently ignored or unrecognized aspect of technology. While the entire case is not presented here, enough information is provided to give the student an understanding and an appreciation of the problem. Questions designed to emphasize important points and considerations are interspersed throughout the reading. Provide ample opportunities to explore these questions fully. At times, the positions presented may get complicated and difficult to follow (depending on grade level, ability of students, etc.). Use the various "probe questions" outlined in the *Teacher's Guide*.

The University of California vs. CRLA case may have some far-reaching implications for researchers and for society in other areas outside agriculture. Pursue this topic with the students. Use a series of "what if" questions to assist you in this activity.

7. Conduct the court simulation debate activity *The Agricultural Mechanization Controversy*

This activity simulates the court case of the farm workers (plaintiffs) vs. University of California -Davis (defendants).

- A. Select 3-5 students (depending on class size) to serve as judges. On the basis of the arguments presented by each debating team, the judges will determine how the courts should decide. The judges should select one member to serve as the Presiding or Chief Judge.
- B. Divide the remainder of the class into two equal teams: the plaintiffs and the defendants. The plaintiffs will "speak" for the farm workers and try to convince the judges that their position is the one they should favor. The defendants will present arguments supporting the University of California. Determine which team will be the plaintiffs and which will be the defendants by "flipping a coin".
- C. Conduct the Debate using the procedures outlined in the *Teacher's Guide* (see "Debates"). While either the "Informal" or the Formal" debate procedure can be used, the "Formal" approach is recommended for use with this chapter activity.

Chapter 9. Medical Technology - Organ Transplantation

1. Have the students read *Recycling Human Bodies* and *Who Gets the Heart?*

It is most important to provide enough time and opportunities to fully explore the various questions posed in the readings. While the first reading is primarily factual, the issues raised in "Who gets the Heart" can be somewhat emotional. The teacher should not allow the discussion to deteriorate into an argument of emotions, but strive to have the students deal with the issues rationally. It is important to create an empathetic and compassionate atmosphere, while at the same time, promote rational decision-making.

2. Conduct the scenario discussion surrounding the *Baby Jane Case*.

Follow the guidelines presented in the *Teacher's Guide*. Scenarios can be very effectively "acted out" using creative drama techniques to heighten the interest of the class.

In discussing the *Baby Jane Case*, make sure that the students focus on why Baby Jane should or should not get the heart. These "why" types of questions are critical for developing thinking skills.

3. Have students write guidelines for organ transplant patient selection.

The guidelines may be written as an individual assignment or as a small-group assignment (3 to 5 students per group). If the guidelines are to be written as a group, it is important that the group as a whole first discuss each topic to get input and opinions from all the members, and to come to some general consensus about the group's major concerns. Each group member should then select a specific topic to develop.

After everyone has completed the assignment, each individual (or small group) will present his/her list of guidelines to the class. While each individual/group is presenting his/her guidelines, the remainder of the class should keep notes on any guideline(s) that

- they disagree with,
- are not clear,
- appear to be faulty,
- seem to be unfair, or
- propose anything else they feel should be questioned, challenged, or discussed further.

After each individual or group presentation is completed, students may then, using their notes as a guide, ask questions, challenge statements and positions, or ask for additional elaboration on any statement made by the presenters. Students should try to analyze all arguments and positions and be on the lookout for any statements or ideas that

- indicate biases as part of the argument,
- are based on unjustifiable assumptions,
- are based on any ambiguous or unfair claims or arguments,
- are inconsistent or based on faulty lines of reasoning, or
- are weak arguments.

NOTE: ANY CHALLENGES OR QUESTIONS RAISED DURING THIS PART OF THE ACTIVITY SHOULD BE MADE IN A COURTEOUS AND RESPECTFUL MANNER.

Chapter 10. Transportation - Space Travel

1. Have students read the background information on transportation.

Once again, it is important that the students critically read and think about the information presented in this section. The questions included in this reading have been specifically developed to help the student relate the information to their own personal experiences. Use these questions (and any others that you may generate) to encourage your students to think about the variety of issues related to the many modes of transportation.

2. Have the students read *The Space Shuttle--A Case Study*.

The script for this activity is based on the actual space shuttle tragedy which took place on January 28, 1986. Many students will be able to add their own personal recollections and experiences to this case study. You may wish to have one student read the case study to the rest of the class in a dramatic setting.

3. Have the students read *The Findings* and *The Recommendations*.

Discuss the questions at the end of this section. Try to get the students to read "into" the data and allow them to arrive at their own conclusions based on the data and information presented.

4. Conduct the *Shuttle Program Discussion Activity*.

Allow the activity to continue as long as it appears useful. Use the guidelines in the Student Guide. You may find it useful to use the best arguments for and against continuing the Space Shuttle program.

5. Conduct the scenario writing activity *Transportation in the Future*.

In this activity the students are to write a scenario based on one of the topics suggested in the Student Guide. Alternatively, they may wish to develop a transportation topic related to their own particular area of interest. The main purpose of this activity is to have the students examine potential changes or effects created by a given decision or situation. Using the scenario format, the students can begin to consider the many complex and intricate issues surrounding the different modes of transportation.

The students should be organized into small groups. Each group should select one of the topics suggested or another topic of their own choosing. After the students complete their scenarios, the scenarios should be presented to the entire class.

Chapter 11. Computer Technology - Robotics

1. Read the "want ad" that opens the chapter to the students.

Have the students try to determine just who or what can fill the job being advertized. This will generate interest in the reading and issues that follow.

2. Have students read background information on robotics.

The reading has been developed to highlight many of the issues surrounding the field of robotics, including latest technology, economic considerations, societal impact, and future possibilities for robotic technology. Students are challenged to make future predictions as they address the questions incorporated in the readings. You should further challenge your students to uncover other issues that might underlie a potential robotic society. You may wish to have the students discuss other sources of information that may contribute to everyone's background on this topic. New information usually appears daily in newspapers or magazines concerning the topic of robotics.

3. Conduct the Case Study *Mr. Harris' Factory, Part 1*.

In conducting this activity, follow the instructions included in conjunction with teaching chapters 4, 5, 6, etc., and conducting scenario discussions. If you have not used this strategy before, it would also be useful to review the material dealing with conducting classroom discussions, scenario discussion, and questioning strategies presented previously in the *Teacher's Guide*.

4. Conduct the Case Study *Mr. Harris' Factory, Part 2*.

The purpose of this activity is similar to most others that utilize the classic prisoners' dilemma approach (Hyman, 1978). The activity seeks to have the students examine the socio-ethical issues related to the scenario pay-off chart. This simulation presents a values conflict in which two students are required to make a decision on the same question but without knowledge of each other's thoughts or forthcoming decisions. There is oral communication at only one point during the simulation.

Make sure that the students fully understand the scenario, how the simulation is to be conducted, its purpose, and the rules before starting this activity.

Mr. Harris' scenario is concerned with a conflict between two people - Mr. Harris and Mr. Fredericks. Each person has the same two choices to make during the simulation. Both have the choice of either installing robots or not installing robots in their factories. There are four possible outcomes:

1. Both install robots.
2. Both do not install robots.
3. Mr. Harris installs robots while Mr. Fredericks does not.
4. Mr. Fredericks installs robots while Mr. Harris does not.

For each of these possibilities, there is a "payoff" in terms of profits that can be gained (see Payoff Chart in the student text).

The conflict in this simulation lies in the way the payoffs are created. These payoffs constitute a non-zero sum game. That is, for each "winner" there is not necessarily a loser, as in a game of football or baseball. The players are confronted with a conflict because it appears that, no matter what choice they make, it appears they will not fare very well.

The players decide to install or not install robots without first talking to each other or knowing what the other will decide. They pass written notes to each other to announce their decision.

No talking or discussion takes place at this point. The players communicate face-to-face only after they have made some initial decisions.

The students require only a pencil, scrap paper, a copy of Mr. Harris' Case Study, and the Payoff Chart. Master copies of the Payoff Chart appear on the next page of this guide, as well as in the student textbook.

Divide the class into pairs and either assign the role of Mr. Harris or Mr. Fredericks to each student or, as a second possibility, have the students select their own preference. Tell them to sit back-to-back without talking to each other at ANY time until directed to do so.

After the first decision is made in writing, the players pass their decisions (slips of paper) over their shoulders to the other players. Each player records each other's response on his, her own record sheet.

There is no suggested time limit for conducting this simulation. The players write 10 separate decisions back-to-back during 10 rounds of play. After 10 rounds, the players confer face-to-face for 3 to 5 minutes about what has happened thus far. The players then repeat the first part, making 10 more separate decisions sitting back-to-back.

After the twentieth round, you should debrief the exercise. This debriefing gives the players an opportunity to find out what others did, to reflect upon what they did, and to put the entire process together.

One strategy you may use for debriefing includes the following:

1. Describe what happened.
2. Analyze the game's message.
3. Plan future discussions and activities.
4. Prepare summary and concluding statements.

Allow ample time for the students to vent some of the feelings they experienced during this activity. Then encourage them to discuss what happened during the simulation using the following questions:

- What decisions did you make?
- Who switched decisions during the game?
- Why did you switch?
- How did you feel about your opponent's decisions?
- Were you able to predict you opponent's decisions? Why?
- Upon what did you base your decision?
- What did you talk about during the 3- to 5-minute conversation?
- What way can we relate this simulation to real-life situations?
- What, if anything, did you learn about compromise?

Help your students to make generalizations and draw conclusions about the simulation and the issues contained in the scenario. Have the students brainstorm a list of ideas that were generated from this simulation. What generalizations and conclusions can be drawn from them?

One final strategy you may wish to consider is to have the students complete the following sentence: *"After going through this simulation, I now realize that..."* You can then compare and contrast the responses by listing the commonalities and differences on the chalk board.

5. Conduct the activity *Examining the Effects of Robots: The Futures Wheel*.

A futures wheel is a technique used to explore the consequences of an idea, trend, or decision. The effects are displayed in a graphic form that permits one to examine multiple interactions and "spinoffs". The central idea/trend is entered in a circle in the center of the paper. Spokes extend from the central circle and end with a circle in which is entered a First-order effect. The process is repeated with second-order effects radiating from the first, third from the second, and so on.

Working in small groups, students will select one of the ideas suggested or utilize one of their own ideas to complete a futures wheel. Review with the students the instructions and the example shown in the student textbook. If possible, it is helpful to have large sheets of paper (i.e., newprint) available. This will permit the members of the group to work on the wheel simultaneously.

CHAPTER 12. TECHNOLOGY AND DECISION-MAKING.

Recently, government officials, as well as the public, have acknowledged the important need to recognize adverse effects of technologies before they become widely instituted. How to avert potential catastrophies and unpleasant side effects is a difficult challenge because there are so many unknowns. We would all welcome an accurate "crystal ball" which forecasts all future effects. But given that crystal balls are beyond our grasps, we have begun to develop methodologies for evaluating the potential impacts of technologies. Such evaluation techniques fall under the rubric of "technology assessment". The purpose of technology assessment is to provide decision-makers and policy-makers with a broad information base to help them make wise judgments. Technology assessment involves a systematic gathering of information using a variety of techniques, including input from experts from various disciplines, evaluating different options; and organizing the information in a useful manner. The focus is not only on direct consequences, but on higher order consequences such as effects on people, social organizations, institutions and the physical environment. In a sense, a technology assessment is a societal impact statement that examines how a technology might influence social, legal, political, economic, and educational sectors. It provides data for decision-making so that people can better select directions for the future.

This final chapter draws upon all of the knowledge and skill the students developed as a result of studying the previous chapters. However, even if the previous chapters have not been studied prior to conducting this activity, students should still be able to accomplish many of the objectives of this chapter.

In this final activity, students will evaluate potential future activities using a technology assessment process. While such techniques as technological forecasting, cost benefit and benefit risk analysis, systems analysis, modeling, and other types of futures forecasting methodologies are beyond the scope of many high school students, they can at least begin to identify and think about how a new technology might influence, effect, or change our existing society. The intent of this simulation is thus to challenge students to search for possible unintended, indirect, or delayed impacts of a new technology in order that people can prepare to make necessary adjustments or appropriate responses.

The students will work in one of four interest groups and assume the role-perspective of that group. From a list of future technologies, they will select those that will best promote the goals of their group. Using the technology assessment flow chart, they will examine each technology and its impact on the areas listed. Based on the assessment, the group will then select four technologies to submit to the World Review Court for final evaluation. To complete the activity the students will write a scenario describing a world of the future where the "court approved" technologies have been instituted.

The following flow chart summarizes the sequence of events for this activity.

SIMULATION PLAN

Part I

Group Preparation

1. Students form four (4) groups. Factory workers, Government Officials, Industrialists, Preservationists.
2. Each group reviews goals, studies issues, and selects four technologies.
3. Each group assesses the four technologies and prepares its presentations.

Part II
World Review Court

1. Class assumes roles of World Review Court to hear presentations of technologies.
2. Court evaluates each technology and approves or rejects it.

Part III
Scenario of the Future

Students write a scenario of the future that describes how the accepted technologies have been or will be applied.

Part I - Group Preparation.

Students will work together in one of four groups:

- Industrial Workers
- Government Workers
- Industrialists
- Preservationists

You may wish to assign students to groups or allow them to select their own groups. In either case, the groups should be evenly divided.

Review the different steps of the simulation so that everyone understands the purpose and the tasks. Have the students examine Diagram 1 which outlines the sequence of events. This is also a good time to review the completed example in the student text so that any student questions about the tasks can be answered before they begin the activity. Each student should receive a copy of the *Technology Assessment Worksheet* (Handout 9). A Master copy of this form appears at the end of this section.

In their groups, the students should begin a discussion of their goals so that all group members will share a common understanding. They should then compile a list of issues or "problems to be solved". This list serves as a guide in helping the group identify technologies related to its goals.

The group members will make their selections from the list of Future Technologies. Since the list is rather lengthy, the members may wish to divide the list and have different members study the various sections. Also, since some technologies will be discarded after the assessment, a number greater than four should be selected. A good strategy is to rank those selected in their order of importance and then evaluate each in turn. When four technologies have been selected, those items remaining need not be further considered.

The members may wish to conduct the assessment and fill in the worksheet as a group or individually. There are advantages to both methods. Group size may be the determining factor. However, having several students provide input facilitates the development of more ideas.

After the assessments are completed and group members have agreed upon the four proposed technologies, each group develops a five-minute report for each technology to be presented orally before the World Review Court. This report is essentially an argument in support of the technology and should demonstrate the beneficial changes that will result if the technology

were adopted. Information from the completed worksheets provides the basic concepts which are further elaborated upon in the report. Allow approximately two to three class periods for the students to complete this portion of the simulation.

PART II. World Review Court Hearing.

At the designated time the class will convene at the World Review Court. One student will serve as the Presiding Judge who is responsible for maintaining order and calling upon presenters in turn. He or she should also be assisted by a time-keeper who ensures that the presentation does not exceed the time limit.

The students must now assume their roles as World Court Judges. Apart from the time when they make their presentations as representatives of an interest group, they must take the role of impartial judges who are responsible for the well-being of the world-at-large. They will undoubtedly experience internal conflict because they are promoting their own proposal and at the same time must exercise objective judgment. In many respects, this is not unlike situations experienced by members of Congress or other elected officials who must respond to the special interests of the constituency who elected them while considering national needs and policy. Try to impress upon the students the importance of their role as judges and challenge them to stretch their critical thinking abilities.

Each student receives a copy of the World Review Court Evaluation Sheet. On it is a list of "objections" that they should consult periodically during each presentation. On the reverse side is a table for recording the results. Master copies for duplication appear at the end of this section.

It may be useful to review with the class the list of objections and cite an example for each objection. This will help the students to better understand the meaning and implications of those objections.

In a rotation sequence, the four interest groups will present their technologies before the World Review Court. Following each report, the judges have an opportunity to cite an objection. Each objection must be accompanied by an explanation as to why the technology is undesirable or potentially dangerous. The Court as a whole will then vote on the acceptability of the objection. Technologies that receive two objections are eliminated.

After all presentations are heard and evaluated, the technologies meeting the Court's approval are announced by the Presiding Judge. The interest group with the greatest number of technologies accepted is declared the group that has successfully achieved its stated goal.

PART III. Discussion of Results and Scenario of the Future.

Following the simulation, the students will write a scenario of the future describing a world where the selected and approved technologies have been instituted. The scenario may be written individually, in small groups or as a homework assignment. In writing the scenario, the students will need to organize some of their own ideas developed during the course of the simulation and explore their thoughts about how the various technologies might influence future events. This writing activity challenges the students to make projections about future changes brought about by the new technologies and to include their personal commentary about those changes. While they have been evaluating technological impact throughout the simulation, the scenario provides a format for students to evaluate the final decisions they made and bring all their thoughts together.

In the scenario the students will answer the question, "How will the future be affected by the decisions we made?" The technologies selected will be examined from a broader perspective

and in terms of how one technology interacts with another. Scenario writing is, in fact, a methodology used by future forecasters to explain or explore a projection of the future. By developing a story or narrative around a series of possible events or desired goals, one can begin to examine the complex interactions of factors and variables of that situation. It provides a flexible format for the writer to consider possible changes, consequences, and interrelationships in a more holistic manner. In this particular scenario-writing exercise, the students will be making predictions about future changes and identifying ways in which society prepares for and responds to those changes. This will enable students to gain additional insights about technology and change.

Follow the guidelines for writing scenarios present in the chapters preceding this one as well as the suggestions provided in the *Teacher's Guide*.

Comments and Suggestions.

The list of "Technological Innovations" included in the student textbook contains a number of technologies that are, of course, unfamiliar to most people. Students will need to learn more about these technologies and the uses. Hence, it is important to provide the students with sufficient time to research. Increased knowledge will help to make the assessment task easier and make the simulation more interesting. The amount of time to be devoted to research is best determined by you and your knowledge of the students' needs and interests.

There are no prescribed time limits for the group meetings. However, a flexible schedule should be established to provide the students with a guideline of tasks to be accomplished.

Student Handout 9
TECHNOLOGY ASSESSMENT WORKSHEET

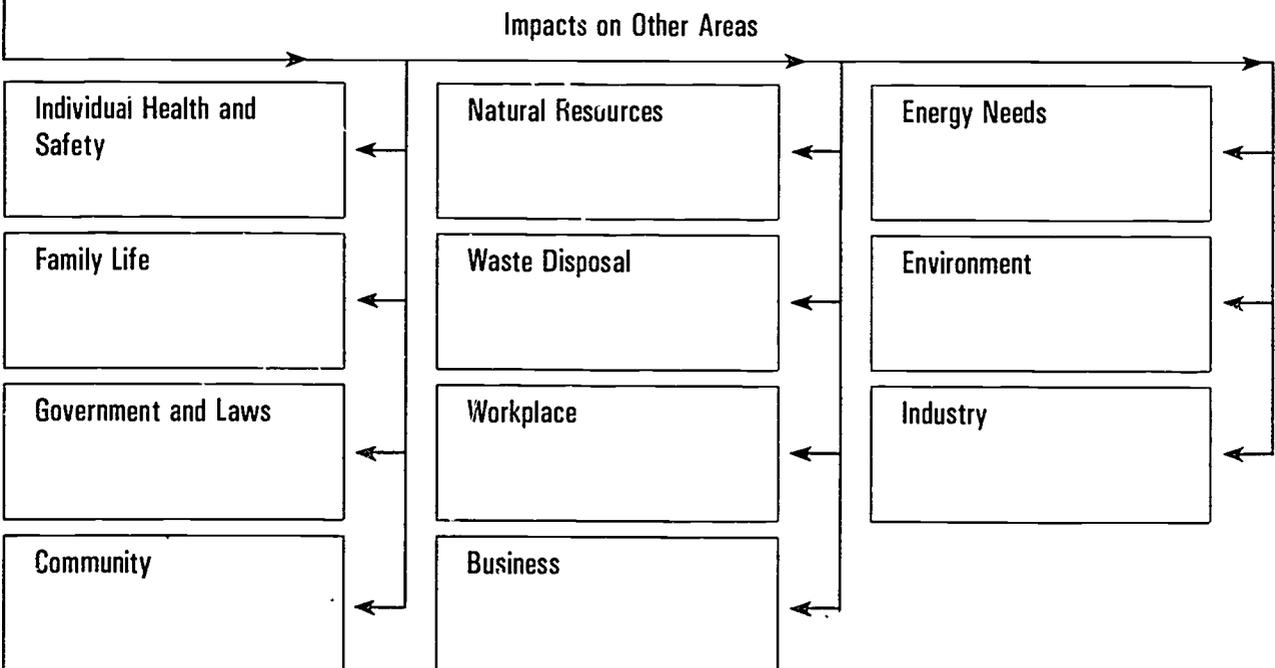
What needs influence the development of the technology?	What are the components of the technology?	Who will control the technology and who will benefit from it?
---	--	---

Technology _____
 Give an example of its use _____

First order consequence – What is the intended effect(s)?

Second order consequences – What effects are related to the technology?

Higher order consequences – What broad changes will occur?



Student Handout 10

WORLD REVIEW COURT EVALUATION SHEET

Objections

The new technology will:

- 1 — Violate individual freedom and freedom of choice
- 2 — Cause irreparable damaging change to the environment of human life
- 3 — Create overcrowding and widespread famine
- 4 — Create large scale unemployment
- 5 — Invade personal privacy
- 6 — Produce dangerous waste products
- 7 — Enable government to make more of our personal decisions
- 8 — Produce conflict between nations and increase likelihood of global warfare
- 9 — Increase the gap between the rich and the poor nations
- 10 — Drain nonrenewable natural resources
- 11 — Create economic instability as a result of government overspending
- 12 — Increase social unrest and conflict by widening the gap between the rich and poor
- 13 — Increase competition among nations for scarce resources
- 14 — Produce situations where people feel alienated, useless or a lack of control over their own lives
- 15 — Leads to "Big Brotherism" — government increases the monitoring of its citizens
- 16 — Reduces the value of human life and human dignity

Instructions:

- Record the title of the new technology presented and the name of the group sponsoring it. During the presentation, you are to decide whether or not the technology will create/cause any of the objections listed above.
- Try to think of different ways in which the technology might be used. Ask yourself the questions: "What might happen if the technology were used or controlled by an unscrupulous person or group?", "What might happen if it were used in ways other than its intended purpose?", or "Will it create unresolvable problems for future generations?"
- When the presenter is finished, you, as

judges, may in turn, cite an objection. Record the number of the objection in the box next to the title. The entire panel of judges will then vote on that objection: *Yes* — if they agree with the objection, *No* — if they disagree with the objection. Record the number of *Yes* votes and *No* votes. Other objections will be made and voted upon in a similar manner. Do this until all objections are heard. A technology which produces *two* or more objections will be eliminated. Therefore, if the judges agree upon two objections, it is unnecessary to hear any additional objections. Proceed to the next technology until all 16 technologies have been heard and evaluated.

RECORD SHEET

Technology	Name of Group	Objection Number and Record of Vote					
1		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
2		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
3		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
4		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
5		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
6		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
7		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
8		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
9		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
10		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
11		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
12		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
13		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
14		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
15		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	
16		Yes	Yes	Yes	Yes	Yes	
		No	No	No	No	No	