July 17, 1974

To the Graduate Council:

I am submitting herewith a thesis written by Ann H. Bitzas entitled "A Study of Technological Topics for an Elective Eleventh Grade Course in Futuristics." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Curriculum.

Charles A. Chance
Charles A. Chance, Major Professor

We have read this thesis
and recommend its acceptance:

Robert Howard

W C Murphy

Accepted for the Council:

Hilton A. Smith
Vice Chancellor
Graduate Studies and Research

A STUDY OF TECHNOLOGICAL TOPICS FOR AN ELECTIVE ELEVENTH GRADE COURSE IN FUTURISTICS

A Thesis

Presented for the

Master of Science

Degree

The University of Tennessee

Ann H. Bitzas

August 1974

ACKNOWLEDGEMENTS

The author wishes to acknowledge her appreciation to her committee: Dr. Charles Chance, Dr. Robert Howard, and Dr. Carl Murphy. The members of this committee have been a constant source of ideas and encouragement throughout the author's work at The University of Tennessee. The author is particularly indebted to Dr. Robert Howard for being the impetus behind the author's interest in the subject of this thesis. She also wishes to express a special appreciation to Dr. John Ray for his invaluable assistance.

Special thanks are offered the author's husband, George, for the patience and encouragements he provided through all crises while this study was in progress.

1164711

ABSTRACT

The purpose of this study was to identify major technological concerns in the writings of "futurists," and to relate these concerns to the needs of eleventh grade students in Knox County high schools in order to formulate a general content area based on the findings for an eleventh grade course in Futuristics.

A search of the literature provided the basis for nine technological areas which seemed to be of major concern to futuristics writers. These nine areas of concentration were incorporated into a questionnaire. The questionnaire was administered to a random sample selection of eleventh grade students, parents, teachers and administrators of the seven Knox County high schools.

An analysis of the returned questionnaires provided the basis for the following conclusions:

1. The total group of respondents gave the topics, Sources of Food and Sources of Energy, the highest ratings in the essential category.

2. The student group of respondents chose the topics, Modes of Transportation and Sources of Energy, as having the highest ratings in the essential category.

3. The parent group of respondents agreed with the total group response by giving the topics, Sources of Food and Sources of Energy, as the topics receiving the highest rating in the essential category.

4. The teacher group of respondents also agreed with the total group by giving the topics, Sources of Food and Sources of Energy, the highest rating in the essential category; however, they also added the topic, Advances in Communications, to their list of essentials.

5. The administrator group of respondents similarly gave the highest essential responses to the topics, Sources of Food and Sources of Energy but added two additional topics, Advances in Communications and Role of Computers.

6. The topics, Weapon Technology for War and Exploration in Space, received the lowest essential ratings by all four groups of respondents.

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION.	1
	Statement of the Problem.	4
	Significance of the Study	5
	Delimitations of the Study.	6
	Definitions of Terms.	7
	Procedures.	10
	Organization of the Study	11
II.	REVIEW OF THE LITERATURE.	12
	Advancements in Biology	12
	Sources of Food	18
	Development of Cities	23
	Modes of Transportation	25
	Advances in Communications.	31
	Role of Computers	37
	Sources of Energy	41
	Weapon Technology for War	44
	Explorations in Space	48
III.	PRESENTATION OF DATA.	54
	Organization and Presentation of Survey	54
	Discussion of Data.	55
IV.	SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS	65
	Summary	65

CHAPTER PAGE

Conclusions 65

Recommendations 68

SELECTED BIBLIOGRAPHY 70

APPENDICES. 75

Appendix A. Cover Letter for Questionnaire to Parents. 76

Appendix B. Cover Letter for Questionnaire to Teachers 77

Appendix C. Cover Letter for Questionnaire to Administrators . . 78

Appendix D. Questionnaire. 79

VITA. 82

LIST OF TABLES

TABLES PAGE

I. Responses from Total Group on Questionnaire Concerning Technological Topics for an Eleventh Grade Course in Futuristics 56

II. Responses from Students on Questionnaire Concerning Technological Topics for an Eleventh Grade Course in Futuristics 57

III. Responses from Parents on Questionnaire Concerning Technological Topics for an Eleventh Grade Course in Futuristics 58

IV. Responses from Teachers on Questionnaire Concerning Technological Topics for an Eleventh Grade Course in Futuristics 59

V. Responses from Administrators on Questionnaire Concerning Technological Topics for an Eleventh Grade Course in Futuristics. 60

CHAPTER I

INTRODUCTION

> For at least six thousand years, to our knowledge, men have persistently and ingeniously sought to foretell the future. The ancient Chinese tried to read their fate by studying cracks in dried turtle-shells. The Babylonians developed the art of astrology still practiced widely today, even in the most advanced countries. The ancient Greeks visited the oracle of Apollo at Delphi and pondered her ambiguous answers. The Roman augurs examined the entrails of animals and birds in order to determine the future and advise the government. The Christians of medieval Europe relied on the Bible and its interpreters, as well as on soothsayers, astrologers, and prophets. Even today most of the world's people still rely on one or more of these pre-scientific methods of predicting the future. The hunger for foreknowledge is age old and universal (Beckwith, 1967, p. ix).

Thus in the past, we have been continually faced with the future. But this confrontation with the future has now assumed a quite different character. Our today is different from any today before it. Different in that the future will no longer be so continuous or familiar, but will be an entirely new age with new challenges of much greater proportions, rooted in structures of a totally different kind.

These days, in fact, changes are coming so fast that we are in danger of being overwhelmed by them. Automobiles have increased to the point where they are fouling the air. New plastics and new detergents are important factors in pollution. Suddenly, modern medicine cuts down the death rate the world over and we find ourselves with a population explosion. The birth-control pill arrives and all our sexual customs change. How can we be prepared for these changes? How can we avoid being overwhelmed by unexpected disaster? Only by looking ahead and trying to foresee what might be coming.

St. Augustine said that time is a three-fold present: the present as we experience it, the past as a present memory, and the future as a present expectation. By that criterion, the world of the year 2000 has already arrived, for in the decisions we make now, in the way we design our environment and thus sketch the lines of constraint, the future is committed. Just as the gridiron pattern of the city streets in the nineteenth century shaped the linear growth of cities in the twentieth, so the new networks of radial highways, the location of new towns, the reordering of graduate-school curricula, the decision to create; or not to create a computer utility as a single system, and the like will frame the tectonics of the twenty-first century. The future is not an overarching leap into the distance; it begins in the present (Bell, 1968, p. 1).

Thus, if the future begins in the present as Daniel Bell has suggested, one would agree with John Kettle in Footnotes on the Future when he says that we should spend every effort to foresee the choices that lie ahead of us. Even though none of the many possible futures is real until we get there; not one is inevitable. But if we go ahead knowing something of them, we shall have more chance of choosing the best and avoiding the worst (Kettle, 1970, p. 7).

The changes that our world has undergone in the past generation forcibly suggest that the next will be revolutionary. There were millions of automobiles running in North America in the 1930's, but the highways were rudimentary. Civilian flying had made a mere beginning. Movies had just started to talk. Television was

scarcely known, radio an infant. Rockets existed in a few eccentrics' backyards and in the comics; the moon was for romantics. Atomic energy was an academic's theory. Most of the products that we buy in the stores had not been thought of.

The many astonishing developments that now seem so central to our lives are in technology.

> In 1970, as in 1940, men go to the office in collars and ties, women in shoes that pinch their toes. Death and taxes continue to be a major human pre-occupation. Boys and girls still fall in love, grow up, have babies, and grow old. People still get their feet wet when it rains, intend to write that letter early next week, take snacks between meals, wish they had more money, ignore advice from the old, and hand it out to the young (Kettle, 1970, p. 8).

Most of that will still be true in the year 2000. It is technology that will change. Technology and population, it seems will dominate our lives as the centruy closes, even more completely than they do now.

For as Alvin Toffler pointed out in Future Shock advances in all fields will fire off like a series of rockets carrying us out of the past and plunging us deeper into a new society. "Nor will this new society quickly settle into a steady state. It too, will quiver and crack and roar as it suffers jolt after jolt of high energy change." There will be no rest from change for the individual, no return to the familiar past. The massive injection of speed and novelty will force man not only to cope more rapidly with familiar changes but to handle at a progressively faster rate strange, irregular, unpredictable "first-time" situations (Toffler, 1970, p. 217).

How do we equip man to handle "first-time" situations? We might do well to follow the advice of Bertrand Russell who said: "When all

the logical consequences of an innovation are presented simultaneously, the shock to habit is so great that men tend to reject the whole, whereas, if they had been invited to take one step every ten or twenty years, they could have been coaxed along the path of progress without much resistance" (Lundberg, 1963, p. i).

The future is our most precious resource. Its exploration becomes a new dimension of our society. Concern for its implications must therefore increase rapidly. "For by making imaginative use of change to channel change, we cannot only spare ourselves the trauma of future shock, we can reach out and humanize distant tomorrows" (Toffler, 1970, p. 487).

This awareness of the future has a place of primary importance in education. Educators have always had the difficult job of trying to prepare young people to live in the world. However, schools can no longer assume that the society into which their students are moving will be more or less like that of the present. Change means choice, and students are already encountering hard choices in the present. These options will continue to multiply whether we are prepared for them or not. Thus creating a futuristic awareness will enhance students' abilities for coping with living in the future.

I. STATEMENT OF THE PROBLEM

The purpose of this study was (1) to identify major technological concerns in the writings of "futurists," (2) to relate these concerns to the needs of eleventh grade students in Knox County high schools,

and (3) to formulate a general content area based on the findings of (1) and (2).

II. SIGNIFICANCE OF THE STUDY

Scholars are warning us that life ahead for the inhabitants in the Western world will become increasingly difficult and uncomfortable despite the material comforts to which most citizens have access. The population explosion will cause human beings to compete for living space, food, water and access to the "better life."

Preparing students to fully live the "better life" has been one of the jobs of education. With the speed of change in the world today the job becomes more urgent. This poses a problem for education seems bound by tradition. This grip must be loosened (Johnson, 1973, p. 518).

Students are already encountering hard choices in the present on how to live, how to work and what values to hold. These options will continue to multiply whether we are prepared for them or not (Livingston, 1973, p. 26). Meanwhile back in the classroom pupils are being readied for crucial challenges via guided tours through historical dustbins. The dead issues of the past are paraded in and out of classrooms. The public school in many ways resembles a kiki bird. The kiki bird used to fly backwards to see where he had been. But the kiki is now extinct (Vonk, 1973, p. 514).

This complex, rapidly changing world obviously can't wait until the harmful consequence of bad choices approach the disaster

stage. Students must become habituated to thinking in terms of alternatives, consequences and preferences when confronted with choices. Thus the rationale for the rise of Futurology exists. "Futurology" or "Futuristics" is an interdisciplinary field which deals in systematic speculation about alternative futures. It may not be possible to accurately predict the future, but it is feasible and necessary to anticipate the options open to us (Livingston, 1973, p. 27).

III. DELIMITATIONS OF THE STUDY

The following limitations were necessitated and observed while conducting this study:

1. The study involved a random sample of eleventh graders, parents, teachers and administrators of the seven Knox County high schools.
2. The topics included in the review of literature related to technology.
3. The subject matter involved was highly speculative.
4. All researching was done by the investigator.
5. The review of literature covered material from 1960 to 1973.
6. The investigator used a subjective approach in analyzing the review of literature.
7. Topics were selected for us in the study based on the frequency of occurrence in the review of the literature. Examples of topics mentioned in the literature not included as major topics in this study were: cybernetics,

government, geography, industrialization, overpopulation, world problems and ecological factors. The above topics were omitted considering the low frequency of occurrence in the review of literature, or oversimplification and overgeneralization of topics for the purpose of this study.

IV. DEFINITIONS OF TERMS

Aquaculture. Scientific cultivation of the ocean's food resources.

Analogs. Synthetic foods produced from a source of protein.

Bio-technology. The manipulation of living things.

CATV. Community antenna television.

Central war. It implies a large war between two major powers involving their homelands. It is sometimes called strategic war.

Cloning. The process of growing from the nucleus of an adult cell a new organism that has the same genetic characteristics of the person contributing the cell nucleus.

Computer. A device which performs operations based on data which are fed to it or stored in its memory.

Computer graphics. Visual arrays or displays produced by computers from programmed instructions.

Cyberculture. The way of life of a society and the science of relationships.

Cybernetics. Science of communications and control. The science that brings together and reexamines lines of research that in the past have been explored separately.

Cyborg techniques. Mechanical aides or substitutes for human organs.

Delphi method. Empirical derivation of a consensus of expert opinion concerning the time scale over which posited technological futures may be realized.

Ecumenopolis. A complex network of large, interconnected urban units.

Eugenics. Science which has as its objective the improvement of the race by controlling factors of heredity.

Extrapolation. The projection of existing trends in functional capabilities for given technological parameters in order to establish the direction in which current developments will carry capability, other things being equal and the time scale for such development.

Forecast. A probabilistic statement on a relatively high confidence level about the future.

Future shock. The shattering stress and disorientation that we induce in individuals by subjecting them to too much change in too short a time.

Geodesic. The shortest distance between points on a curved or spherical surface.

Geodesic form. Gives maximum enclosed volume with minimum enclosing surface.

Geothermal. Heat from within the earth.

Helography. The technique of producing images by wavefront reconstruction especially by using lasers to record on a photographic plate the diffraction pattern from which a three-dimensional image can be projected.

Impact analysis. Analysis of the likely impact on other sectors of new technological developments.

Laser. Light Amplification by Stimulated Emission of Radiation.

Megalopolis. Large urban complexes with populations from ten to sixty millions.

Morphological analysis. Analysis of the structure of technological systems into basic parameters and the exhaustive identification of the alternative ways of fulfilling those parameters. The matrix so prepared affords the opportunity to explore new combinations.

Nth power problem. Acquisition of atomic weapons by nations or blocs other than the United States, Great Britain, and the Soviet Union.

Nanosecond. One-billionth of a second.

Projection. A datum in a forecasting exercise.

R and D. R stands for research in pure theory and D stands for the development of some practical application for technology.

Relevance Trees. Diagrammatic representation of the sequential paths through which development must go in order to achieve a technological mission. Allied to networking and criticap-path method, it acts as a powerful tool for planning, coordinating and reviewing progress towards a goal.

Scenario. Postulated future technological capability serving as a creative input to technological forecasts. The probability of its attainment and the time scale for development are not known.

Technology. The broad area of purposeful application of the physical, life, and behavioral sciences. It comprises the entire

notion of technics, as well as the medical, agricultural, management, and other fields as their total hardware and software contents.

Teleportation. Transmission of a human body, including its personality, from one place to another, without using mechanical or electronic means.

V. PROCEDURES

The data have been selected from recurrent technological comments of selected philosophers, sociologists, psychologists, educationists, architects, engineers and selected other writers concerned with the future.

1. Writings of these futurists from 1960-1973 were reviewed and technological topics of greatest frequency of occurrence in review of literature were selected.
2. Questionnaire was constructed by the investigator using nine topics of concentration found in the review of the literature as the major categories.
3. Questionnaires were sent to a random selected sample from 1,733 eleventh graders, 1,733 parents, 355 teachers and 43 administrators of the seven Knox County high schools. The students and parents were identified by a computer print-out sheet obtained from the Knox County Schools Computer Center. The teachers and administrators were identified from the 1974-1975 Knox County Teachers Association booklet.

4. Based on findings of this study, general technological topics were chosen as subject content for an elective eleventh grade course in Knox County high schools entitled, "Futuristics."

VII. ORGANIZATION OF THE STUDY

Chapter I presents the introduction, a statement of the problem, the significance of the study, delimitations of the study, definitions of terms, procedures and organization of the study. Chapter II presents a review of the related literature. Chapter III contains a discussion of the selection of the sample, instruments used, the procedures followed and the analysis of the data. Chapter IV contains the summary of the study, the conclusions and recommendations.

CHAPTER II

REVIEW OF THE LITERATURE

Discussed in this chapter are the literature and research related to topics of major concern for the future.

I. ADVANCEMENTS IN BIOLOGY

Bursting with idealism, students everywhere are confronted with yesterday's science fiction operating as today's fact and probability. New genetic knowledge will permit us to tinker with human heridity and manipulate genes until we create new versions of man.

Nobel Laureate Joshua Lederberg when answering Alvin Toffler's question of the possibility of cloning said:

> It has already been done in amphibia and somebody may be doing it right now with mammals. It wouldn't surprise me if it comes out any day now. . . . But I put the time scale anywhere from zero to fifteen years from now (Toffler, 1970, p. 198).

Not so shock endowed as cloning is the progress in transplants to the human body. According to Desmond King-Hele in The End of the Twentieth Century?, transplants will be very popular with thousands of maimed or debilitated people needing new limbs, hearts, kidneys, etc. He suggests that "spare part" surgery will be limited only by money, availability of surgical teams and the supply of spare parts. Already transplant surgery has moved from the main front page headings to the second or third page of many papers (King-Hale, 1970, p. 100).

However, transplants, as reported by William Carley in Here Comes Tomorrow, will give way to permanent replacement of entire diseased organs. Artificial hearts made of plastic or rubber initially could be powered by batteries in one's pocket. The power would be transmitted through the skin by radio waves. Ultimately power sources would be implanted in the body (Carley, 1966, p. 168).

Already artificial kidneys and cardiac pacemakers are widespread. Miniature hearing aids for the deaf and ultrasonic walking sticks for the blind have enriched many lives. Artificial limbs have been developed that operate by will-power by utilizing the remaining muscles of the stumps of arms. We are likely to see notable expansion in cosmetic surgery. It may be possible to chemically change the color or the skin. Synthetic bones and skin are under experimentation (Torrey, 1970, p. 32).

Carrying the concept of artificial parts to an ultimate idea Alvin Toffler quoted Arne Tiselius, the Nobel prizewinning biochemist as saying that one might even conceive of biological components in machines (Toffler, 1970, p. 196). Jean Fourastie the French economist and planner stated:

> Man is on the path toward integrating living tissue in the processes of physical mechanisms. . . . We shall have in the near future machines constituted at one and the same time of metal and of living substances. . . (Fourastie, 1965, p. 17).

Machines are even making inroads into psychiatry and the human mind. Conditioning by electric shock was performed in England to cure an unfaithful husband of illicit desires. Dr. Jose M. R. Delgado

at Yale has used machines to control the minds of animals. He implanted electrodes in the brains of monkeys causing them to reject their offspring when stimulated by remote radio signals. He also implanted electrodes into the brains of bulls thus controlling their charges toward matadors in mid-flight (Torrey, 1970, p. 32).

Theodore Gordon in The Future brought up the possibility of human beings being subjected to brain operations during which electrodes were implanted in the brain cortex. Radio receivers could transmit reward or punishment. Several key citizens could have their cerebral responses amplified and collected by governmental receiving stations. These signals could help the government adjust policies to better satisfy the citizens. Or people could be bred expressly for the purpose of being fitted with bio-control attachments to serve. They would react only to commands of master. This could be the world's first robots (Gordon, 1965, p. 16).

In a quite different field of robotology there is progress, too. In Disneyland technicians have created life-like computer controlled humanoids that grimace, smile, show fear, chase girls, and play music. The purposes behind these robots may seem trivial but the technology is highly sophisticated. It is suggested in Toffler's Future Shock that the day will come when the airline passenger will have difficulty in determining whether the smiling, assured humanoid behind the reservation counter is a pretty girl or a carefully wired robot (Toffler, 1970, p. 211).

In Toward the Year 2000 published in 1967, Herman Kahn and Anthony Wiener give many biological technical innovations which they forecasted to appear in the next thirty years.

1. Extensive use of cyborg techniques.
2. Human "hibernation" for short periods for medical purposes.
3. Practical use of direct electronic communication with and stimulation of the brain.
4. Capability to choose sex of unborn children
5. Improved capability to "change" sex
6. Genetic control over the "basic constitution" of an individual.
7. Increase in life expectancy, post-ponement of aging, and limited rejuvenation
8. Simple techniques for extensive and "permanent" cosmetological changes
9. More extensive use of transplantation of human organs
10. Chemical methods for improved memory and learning
11. Programmed dreams (Bell, 1968, p. 80).

As the brain surgeons and neurologists probe further, and as bio-engineers and robot builders become more sophisticated in their products, as machines begin to embody biological parts and men become equipped with sensors and mechanical organs, man must change his outlook. He must come out of his complacent past orientation and his unwillingness to confront the reality of acceleration. He is moving into a new stage of eco-technological development. He can no longer maintain that "human nature is eternal" or that "stability will return" (Toffler, 1970, p. 214).

Man must be prepared for breakthroughs in birth-technology. For many centuries people have imagined that babies might be grown like plants. Aldous Huxley's Brave New World introduced the baby-factory with controlled batches of Alphas, Betas, Gammas and Deltas carefully reared at the thirty-four storey Central London Hatchery (King-Hele, 1970, p. 105).

It is possible that the road to the baby factory is foreseeable. Directions have been taken in artificial insemination, and the growth of the artificially conceived embryo in an artificial environment. Some methods of the 1990's might prefer to avoid the nine months' hard labor, and obtain a better specimen of a baby by sending the fertilized egg to the forcing house (King-Hele, 1970, p. 107).

Dr. E. S. E. Hafez, an internationally respected biologist at Washington State University, has suggested on the basis of his work in reproduction that within ten to fifteen years women will be able to buy tiny frozen embryos. The woman would have the embryo implanted in her uterus. This would be a way of insuring the mother of a child free of genetic defect. Other aspects might also be involved such as choice of sex, I.Q., eyes, hair and probably size at maturity (Toffler, 1970, p. 199).

Some scientists believe the artificial womb can be perfected. At Stanford University's Medical School in Palo Alto, California, scientists have made major steps in using the artificial womb as an aid for babies born too prematurely. They predict that within a decade babies born as early as the twentieth week of pregnancy will be able to survive (Carley, 1966, p. 175).

Indeed, it will be possible to go another step and do away with the necessity for the female uterus. According to Toffler if the work begun by Dr. Daniele Petrucci in Bologna continues along its current path it will be possible for women to have babies without the discomforts of pregnancy (Toffler, 1970, p. 200).

With the advances in reproduction are we hurtling toward a time when we will be able to breed both super and sub races? Theodore J. Gordon in The Future discusses the application of selective breeding in man. He points out instances of selective breeding in history. In early Sparta, before the time of Christ, defective babies were sentenced to death by exposure on Mount Taygetus. The idea of selective breeding was accepted; execution of the less fit was an accepted custom. Two thousand years later in Nazi Germany the idea of selective breeding arose again. In June 1933, marriage loans were introduced in Germany. Marriages were for the benefit of the state. Under the marriage loan plan healthy, politically acceptable applicants were granted interest-free loans. The birth of each child canceled one-quarter of the loan. Inter-racial marriages were punishable by death. Hereditary diseases and defects were dealt with in a medico-judicial court where sterilization was freely prescribed (Gordon, 1965, p. 26).

Eugenic control may be advocated in the future. DNA analysis and alignment may be given with the pre-marriage Wassermann test. Gordon speculates on what the race of the future might be:

> A superior group, the DNA controllers; the humble servants; special athletes for the "games"; research scientists with

> 200 I.Q. and diminutive bodies; and finally the eternal model of youth for sex? (Gordon, 1965, p. 34).

John Kettle in Footnotes on the Future suggests that first mankind may need to consider a question asked by Sir Julian Huxley, "What is man for?" He feels that if we can't agree on the answer we will have a hard time agreeing on how we want to change him, which model to follow, which qualities and capacities to erase and which to multiply. Kettle states this to be as the fundamental human question today (Kettle, 1970, p. 140).

II. SOURCES OF FOOD

With the advancement of bio-technology comes the need for food supply to sustain living humans. Dr. Paul R. Erlich in The Population Bomb is rather pessimistic on this subject. He says that the world is rapidly running out of food. In fact, that the battle to feed humanity is already lost in the sense that we will not be able to prevent large scale famines in the next decade or so (Erlich, 1968, p. 18).

In Toward Century 21 Erlich again pointed out disfavorable condition of food supplies. He stated that in 1966 the world had increased by 70 million individuals yet no additional food was grown to feed them. Thus Erlich states that in that year each person on earth had two percent less to eat.

Agriculture experts state that a tripling of the world's food supply will be necessary between now and the next century, if the six or seven billion people who may be alive then are to be reasonably fed (Erlich, 1970, p. 54).

Another pessimistic outlook is offered by Stuart Chase in The Most Probable World. Chase would disagree with Erlich's idea of the need for increasing food supply. He states that more food only postpones the crisis; it does not solve it. Even with the most advanced technical aid, the supply of food cannot keep up with population at the present rate of growth. He points out that in 1965 when national food stocks were near their peak that the United States had enough surplus wheat to feed the world for just two weeks. Chase agrees that food can be dredged from the sea; it can even be synthesized. But, these processes take time, and enormous capital only to be temporarily effective to deal with current population predictions (Chase, 1968, p. 50).

What are the facts? Food is the first essential. We are so accustomed to the well-stocked kitchen shelves and the abundantly filled dinner plate that it is almost impossible to imagine what life must be like for those on the brink of starvation. According to John Kettle in Footnotes on the Future:

> In theory starvation need never occur; in practice, it appears to threaten large regions of the world. It is an absurdity in the twentieth century, or in any other century (Kettle, 1970, p. 40).

Kettle proposes some questions aimed toward improving the outlook. Could we not take advantage of food from oceans? Could we not cultivate even part of the land that is now idle? Could we not process and eat more than one-fifth of plants as we are currently doing? Could laboratories and factories not do better than even plants and animals in producing food? (Kettle, 1970, p. 41).

The most immediate answer lies in improving the efficiency of all existing agriculture. This could be done by planting better varieties of seed, by proper irrigation, drainage and fertilization, aided by mechanization and weed killers (King-Hele, 1970, p. 58).

Sylvania Electric Products Incorporated has found it can speed the growth of plants 25 percent to 30 percent. Using wide spectrum fluorescent lights tomatoes, for instance, might be grown faster and in larger quantities on huge "indoor" farms. Oil companies have found through experimentation with bacteria and yeasts in fermentation that a powder can be produced with a 60 percent high quality protein and vitamin content. Scientists have taken this discovery and are trying to convert the powder into products that taste like fish or meat (Bray, 1966, p. 18).

Greatly advanced methods of food production include more efficient extraction of foods from the oceans. Oceans teeming with life cover nearly three-quarters of the Earth's surface. Fish-hunting is still rather primitive. However, it could be much more successful than land hunting because fish have habits of gathering in shoals. But most of the yield from fish-hunting will go into fish-meal for feeding animals. The population of "wild fish" is limited, so fish farming will probably be necessary (King-Hele, 1970, p. 61).

Aquaculture is now becoming technically feasible. It can produce four to twelve crops a year of potatoes, yams, Chinese cabbage, tomatoes, peas, eggplant, melons, etc. using synthetic fertilizer. Algae culture based on synthetic nutrients can produce protein suitable for direct human consumption (Mier, 1969, p. 110).

"But of all ocean resources, water is by far the most valuable part of each gallon of ocean." Desalination plants are operating at various parts around the world. Hopefully nuclear desalting of sea water will be the answer in the long run. This water could be used to irrigate in arid areas (Kettle, 1970, p. 57).

New fertilizers and soil restorers are now being developed. With these aids of the twenty-six billion unused acres in the world it is considered that between one and two billion could eventually be farmed. In Australia the water supply is adequate but lack of minerals leaves the land a barren waste. It has been estimated that in Australia alone 300 million acres of land could be recovered by adding trace elements to the soil (Kettle, 1970, p. 45).

Scientific technology is at last turning on the table with some efforts previously used in war and industry. With few exceptions everything we eat comes from something. Bacon comes from pigs. Milk comes from cows; cereal from grain, etc. But the day can be forecast when breakfast will come from a DNA factory where living cells will change inert organic compounds into the twenty-first century equal of ham and eggs (Gordon, 1965, p. 33).

General Mills has developed a process for increasing the supply of protein. The base substance comes from soybeans. Through developmental processes the fiber is reconstituted in high protein chunks of food that are difficult to distinguish from real meat. Synthetic entrees such as this are called "analogs." According to Arthur Odell of General Mills, "Analogs can be produced to meet almost

any conceivable dietary, religious, ethnic or geographic ground rules." Analogs have the advantage of being produced at an efficiency rate of 80 percent, with only 20 percent of protein lost. They cost only half as much as meat with comparable protein (Bray, 1966, p. 25).

Food pills are now realities. Pillsbury's Bauman says such foods can be kept for years if properly packaged. These could be used for long trips such as submarine or space vehicles might need. However, pills alone must be ruled out as diets of any duration, due to lack of bulk slowing down digestive processes (Kettle, 1970, p. 55).

Someday when a man says, "This doesn't taste like my mother's cooking," he may be remembering a silver-haired lady carefully mixing an array of vitamins and chemicals in the twenty-first century equivalent of our kitchen (Gordon, 1965, p. 65).

Food supply is an area of concern for futurists. But how are people to become aware of this critical topic? Buckminster Fuller in I Seem To Be a Verb may have the answer.

> Technology providing more and more goods from fewer and fewer resources could guarantee that all men would survive. It is very logical that man should fight to death when he thinks there's not enough to go around.
>
> In a fire, he loses all reason, goes mad, and tramples his fellow men to death as he competes for air.
>
> It is also very logical that man won't fight when he knows there's enough to go around. It is logical. It is logical. It is logical (Fuller, 1970, p. 17B).

The easiest solution to the food problem was offered by Theodore Gordon in his book The Future. He said in the society of the future, no one will be hungry. This will be true because computers will have solved the problems of what to plant and where and when to plant it. The problems of distribution will be solved because there

will be a central hunger control agency which will assimilate all the data needed for appropriate distribution throughout the world (Gordon, 1965, p. 64).

III. DEVELOPMENT OF CITIES

Next to food, the most important item in the budget is living quarters. By the year 2000 the United States will have a population of about 300 million. Sometime before the end of the twenty-first century we will cross the one billion mark. Housing of these numbers is an enormous undertaking (Porter, 1971, p. 34).

Most of the houses will need to be located in the cities. Many people conceptualize the relations of cities differently. Desmond King-Hele suggests his plan of a triangular basic grid. Towns will be in a grid pattern each approximately fifteen miles apart. Each town will be linked with six others by some means of transport. Each town would specialize in some way such as industry, manufacturing, university and cultural center and seaside resort. In the countryside between the towns, existing villages would be preserved, but mainly this area would be used for recreational facilities. The towns would have populations of 30,000 to 100,000 inhabitants (King-Hele, 1970, p. 153).

Greek town planner, Constantinos Doxiadis of the Athens Center of Ekistics, advocates the rise of the Megalopolis. The term Megalopolis, "the gigantic city," was first coined by University of Pennsylvania urban expert, Jean Gottmann. All around great cities

grow vast accretions of surburbia that merge into a dense central core. In the United States are found the greatest conurbations. One of the best known is the area from north of Boston to south of Washington. Gottmann would refer to this area as a Megalopolis.

So it is not fanciful in light of present day technology to consider the megalopolises of the future as single cities that would each house populations that would rank among the top half dozen nations of the sixties (Kettle, 1970, p. 30).

John G. Papaioannou also associated with the Athens Center of Ekistics, focuses on the concept of "Ecumenopolis." Ecumenopolis would involve the interconnection of megalopolises into a larger unit. This idea supports a view by Doxiadis that all men 150 years from now will live in one universal city that spreads around the globe. The Ecumenopolis is likely to appear in the latter part of the twenty-first century and develop slowly through the beginning of the twenty-second century (Papioannou, 1969, p. 231).

Population pressures could drive mankind to seek inhabitation in polar areas, the oceans, the sky and even other planets (Gordon, 1965, p. 21). Domed cities might provide new opportunities for man. Buckminster Fuller states that domed cities will be essential for occupying deserts, the Artic and Antartic. In other areas domed cities would reduce energy losses in summer cooling and winter heating up to one eighty-fifth of our present cost. Thus, money saved could pay for the dome in ten years. Windows could be open year round. Gardens would have no particular season. There would be a dust free atmosphere (Fuller, 1970, p. 59).

Sea cities might open another direction for occupancy. Dr. F. N. Spiess, head of the Marine Physical Laboratory of the Scripp's Institution of Oceanography, said that within fifty years man will move onto and into the sea. But how could man live in the sea? Dr. Walter Robb, a scientist at General Electric, has already kept a hamster alive living underwater by enclosing it in a box that simulates the effect of an artificial gill. Synthetic membranes that extract air from water and keep water out might be built into walls of undersea apartment houses. Toffler points out that the science-fiction idea of men with surgically implanted gills seems no longer quite as impossible as it once did (Toffler, 1970, p. 190).

Not only cities of the ocean but cities in the air are now a real possibility. Geodesic spheres larger than a half-a-mile in diameter can be floated in the air like clouds. These "cloud nines," as Buckminster Fuller calls them, could house thousands of people, whose weight would be negligible. People could move from "cloud" to "cloud" or from "cloud" to ground. These "clouds" could float freely around the Earth or be anchored to mountains. By impounding sunlight these clouds could become food factories (Fuller, 1970, p. 75).

> Thus it is possible and necessary if society is to continue on Earth for professional scientists, engineers, and architects to anticipate needs of not only the next generation, but of all generations to come (Fuller, 1968, p. 137).

IV. MODES OF TRANSPORTATION

> For millenia the average man traveled 30,000 miles. Today, the average man travels 3,000,000 miles. As the

> ecological revolution continues, man may some day travel 3,000,000,000,000 miles (Fuller, 1970, p. 55B).

Najeeb E. Halaby, former administrator of Federal Aviation Agency, refers to the twentieth century as the "Century of Transportation." He cites the development of the steam and gas turbine, the refinement of the internal combustion engine, the Wright brothers' leap from the bicycle to the airfoil and Frank Whittle's surge from the prop to the pure jet. Moving ahead the twenty-first century will be the Nuclear Age. The population explosion, the expansion of knowledge and education and new prosperity will create a new impetus for travel (Halaby, 1968, p. 14).

We can imagine a very exciting urban future for the year 2000, but we must solve some very difficult problems before this future can be realized. If our present urban trends were to continue at least 290 million out of a total population of 350 million might be living in urban areas. New super highways could be cutting cities to ribbons and yet intown transportation would continue to be a headache. Downtown congestion and lack of parking space would continue to be the order of the day (Perloff, 1968, p. 158).

Thus the outlook for the private automobile is extremely doubtful. The automobile up to this time has been a convenience and a an aid in integrating the United States. But today its convenience is overbalanced by inconvenience. No longer in congested areas can it be considered a form of rapid transit. Higher insurance rates, high costs of operation, lack of parking or garage space and rising number of serious accidents make its convenience questionable (Lundberg, 1963, p. 308).

Najeeb Halaby refers to the automobile as inefficient, noxious and incompatible with anything but a spendthrift society. Buckminster Fuller in agreement with this concept points out that we are still producing two-ton, eighteen foot long automobiles mainly to carry one person. And that if the weight of materials involved in this automobile were properly designed and employed that it could easily carry six persons (Fuller, 1970, p. 110B). Yet we still have:

> The average 150 pound driver tooling down a million dollar-a-mile highway, here or abroad, in two-tons of expensive and rapidly deteriorating machinery, bound for a destination where it may cost him the price of his day's food to park. . . (Halaby, 1968, p. 39).

Martin Shubik, a member of the Carnegie funded Commission on the Year 2000, offers some modifications toward solving the technological traffic problem. He suggests placing a high tax on privately owned automobiles and a low tax on rented or leased automobiles. There might be mammoth networks of Hertz companies ready to bring a car to your doorstep. The user would have a credit card that would be punched with the number of automobile hours used (Bell, 1968, p. 23).

Moving even further away from the concept of personal-owned automobiles is Demond King-Hele. He introduces the idea of small publicly owned electric cars. In the cities these cars could be found at parking meters. By inserting a nickle one might obtain three miles of driving. Outside the cities these cars might run on highways guided by wires in the road at an automatically fixed speed. These might be used mainly for cross town travelers. The traveler getting in

the car would write his destination on a card then insert the card and his credit card into a slot and press the starting button. The car would proceed at a steady rate to the traveler's destination with the charges being relayed to the traveler's account.

Away from the cities, cars of the present type may continue to be used with modifications. New laws against fumes and noise will increase. Some degree of automatic control may be installed. Some electronic wizardry under roads may cause cars to travel in groups kept at a constant speed and constant distance apart (King-Hele, 1970, p. 79). Halaby suggests that passenger cars and trucks may no longer mix on the public highways. Each might have its own right of way (Halaby, 1968, p. 42).

"But what is needed is a way to get more people into a minute. . . ." In Japan trains operating on the Hokkaido line now cruise at twice the speed of early airplanes. Experiments with high speed trains are underway in Scotland, France, Eastern United States and Canada (Ruppenthal, 1970, p. 158).

The Canadian National's Rapido service is one of the fastest railway passenger services in Northern America. The Rapido averages sixty-seven m. p. h. The goal for CN's Turbo Train is an average of eighty-four m. p. h. (Kettle, 1970, p. 76).

Thus railways may enjoy a striking renaissance. The possibilities for trains are innumerable. The growth of high speed electric systems will continue. These may be joined by pneumatic trains blown along transparent tubes by compressed air and drawn on by air sucked

out in front. Electric trains may hang from monorails; rockets or gas turbines may advance propulsion. Hovertrains may float on a thin cushion of air being driven forward by linear induction motors (King-Hele, 1970, p. 80).

The railways had practically been written off by transportation people. It was thought that the railways born in 1825 had reached their peak in the 1920's and were racing toward an inevitable decline. Yet, as an editorialist wrote in the magazine Trains in 1959:

> . . . a passenger instrument that can propel 200 to 300 people at 80 miles an hour with only 1500 horsepower and a crew of three or four men is not bound for the museum. . . (Kettle, 1970, p. 76).

Water transport modes have an important future also. Hovercrafts, hydrofoils and possibly fast submarines may be in the future (Ruppenthal, 1970, p. 158). Hovercrafts may not only play a role in sea travel but also as a form of air travel over land. A craft that rides on a thin cushion of air is being explored by many. The British government's hovercraft is propelled by linear induction motors along concrete roadways embedded with guide rails. The French government is studying an Aerotrain currently powered by a rear propellar. Ford industry did work on a Levacar and General Motors has its Hovair. There is little doubt that some form of air cushion vehicle will be in use by the year 2000 (Kettle, 1970, p. 78).

New short-haul craft may benefit the traveler greatly. It will carry more passengers and operate more cheaply than today's helicopters. They will be capable of operating from areas no larger than small city parking lots or piers. They may be used for travel between

downtown areas, in highly congested areas or flying from one city to another thus eliminating the long journeys to outlying city airports (Cooke, 1966, p. 82).

In the field of long distance people transport the airplane will be pre-eminent. Najeeb Halaby, Senior Vice-President of Pan-American World Airways, states that with present day capabilities there seems to be no reason why aircraft cannot carry 700 to 1,000 people (Halaby, 1968, p. 42). Desmond King-Hele points out that by the end of the century it should be technologically possible for aircraft or semi-spacecraft to take people anywhere in the world in two hours (King-Hele, 1970, p. 75).

The ultimate in air travel as seen by aerospace planners is the HST. The hypersonic transport may be in commercial service by the 1990's. It might hit speeds of 6,000 m. p. h. (Cooke, 1966, p. 73). What about passenger rocketry? Is it feasible? Yes, but it is not likely by the year 2000. The idea of rockets moving people about at speeds of 15,000 m.p.h. has been discussed and mostly ruled out by aerospace authorities. It would be possible to deliver people to far distant points in a few minutes; however, the discomfort of high acceleration and deceleration might prove too difficult (Cooke, 1966, p. 75).

Arthur C. Clarke feels that potentially space travel need be no more expensive than aviation. And that the engineering problem of interstellar travel is quite trivial. He points out that already a Saturn 5 could send a Volkswagon to Alpha Centauri with only one snag.

It would take a quarter million years to get there. Thus intersolar flight becomes a biological problem rather than an engineering problem (Clarke, 1968, p. 255).

With all these advancements in travel nations would seem like counties and continents like states. By means of nearly total mobility mankind will have nearly achieved what Moses reported in Genesis:

> And God said . . . let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth (Genesis 1:26).

V. ADVANCES IN COMMUNICATIONS

Dr. Robert Hilliard, the top educational broadcasting specialist for the Federal Communications Commission, states that at the rate knowledge is growing by the time a child born today graduates from college, the amount of knowledge in the world will be four times as great. And by the time that same child is fifty years old knowledge will be thirty-two times as great. But even more startling according to Dr. Hilliard, is the fact that 97 percent of everything known in the world will have been learned since that child was born (Toffler, 1970, p. 157).

Language, too, is convulsing. According to lexicographer Stuart Berg Flexner, senior editor of Random House Dictionary of the English Language, "The words we use are changing faster today, not merely on the slang level, but on every level. The rapidity with which words come and go is vastly accelerated. This seems to be true not only of English, but of French, Russian and Japanese as well (Toffler, 1970, p. 169.)

There was a time when a man learned the language of his society he could make use of it with little change throughout his lifetime. Today, to an astonishing degree, this is not possible. Don Fabun in Dimensions of Change highlights this language change. He points out that in his list of fields of technology in communications the majority of the terms did not exist prior to World War II:

Kinaesthetics	Holograph
PBC-TV	Magnetic Tape Cassettes
CATV	Microfiche
EVR	Plasma Crystals
Laser; Sonar	Computer Graphics
Unifor Facsimile	Voice Recognition
Quadrasound	Synaesthetic Cinema

(Fabun, 1971, p. 203).

We seem to be in the midst of an Information Explosion. "The human appetite for 'more' and 'quicker' has become a demonic driver." Kettle points out that this drive has resulted in newspaper, magazine and book publishers becoming nervous citizens. There are those who say books are on their way out. McLuhan compares the book to the dinosaur just before he disappeared (Kettle, 1970, p. 86). Don Fabun suggests that perhaps well before the year 2000 a definition of illiteracy may be "the ability to read words" (Fabun, 1971, p. 203).

John Kettle states that there will be a revolution in the print media. Its function will have to be that of supplying more detail, more background, more analysis than television has time or demand for. New methods of presenting material will surface. RCA has a type-composing system capable of setting the entire text of a newspaper page in two minutes. Computer codes will enable type to be instantly transmitted anywhere. Bell Telephone Laboratories using pulse code

modulation in an experimental system have been able to transmit 40,000 average sized books an hour or eleven books a second. Installation of home newspaper printer devices may enable the occupant to receive an immediate outpouring of news in his personal breakfast nook (Kettle, 1970, p. 88).

Burnham Beckwith in The Next 500 Years predicts that print material will continue in the trend of microfilm slides and films. Gradual adoption of the practice of lithoprinting or microfilming of typescripts rather than printing them will arise (Beckwith, 1967, p. 201). The National Cash Register Company's method of PCMI, Photochromic Micro-Image, for reducing the printed page to a fraction of its original size will provide an economical way of storing print. This way books could be published in computer tape or microfiche and printed out on demand (Kettle, 1970, p. 89).

Philip Stone in Toward Century 21 states that in the next fifty years there will be a major increase in resources for "on demand" information. Computers will feed information into terminals in schools, homes, and offices. Johnny can use it for his homework; mother no longer need use her fingers to walk through the Yellow Pages; and dad will have immediate access to information on stocks and bonds (Stone, 1970, p. 240).

Karl Steinbuch suggests an idea similar to Stone's "on demand" information. He sees the arrival of information banks and information grids. The information bank will be a special computer with a very large storage area that will classify, condense, store and issue information upon request. Information grids will exchange information between

information banks. He also suggests teaching programs that might be reached by merely dialing the telephone (Steinbuch, 1969, p. 168).

Television has made more impression on our lives than any new technology since the automobile. In 1967 UNESCO reported that there were some 200 million television receivers in the world (Kettle, 1970, p. 96). Philip Stone in Toward Century 21 stated that better than 93 percent of American households have at least one television set. This statistic is an amazingly high percentage when compared to the fact that only slightly over 80 percent of American homes have telephones and only 72 percent have a vacuum cleaner. And in terms of attention, the average American adult gives television their primary attention over ninety minutes per day and divided attention over two hours per day. This makes television the most important mass media today (Stone, 1970, p. 238).

"By the year 2000 most European and American families will have three or more radio sets and two or more television sets. By 2200 most Asiatic families will have this many." Today the average television set receives only two to six broadcasting stations. By 2100 the figure will be over fifty in advanced countries (Beckwith, 1967, p. 212).

Television will be 3D and in color. Color adds to the cost but will be universal by the year 2000. The ultimate objective of the medium will be complete emotional participation. Theodore Gordon suggests that the television set of the future will perhaps be a helmet which presents stereo pictures to the eyes, stereo sound to

the ears, odors to the nose, and a certain feeling to the back of the neck (Gordon, 1965, p. 90). The range of pictures sizes will be greater. General Electric envisages a forty-two inch tube. At the lower end a British inventor has marketed a two-inch screen. Westinghouse has a picture tube the size of a nickel on their shirt-size pocket transitor model. But NCR holds the record. They have a screen one-sixteenth of an inch square. ABC television executive, Bernard Saperstein said he expected wrist television sets, wall-to-wall and floor to ceiling home screens and sets so cheap they would be sold in drugstores and supermarkets (Kettle, 1970, p. 97).

Communications satellites will play a major role in increasing the communication's network capacity. Only twenty years after Arthur C. Clarke had asked in 1945 if rocket stations could give world wide coverage the Early Bird satellite had become a commercial proposition (Michaelis, 1969, p. 172).

Present communications satellites are tiny compared to those engineers expect by the turn of the century. Satellites with capacities equivalent to 60,000 telephone circuits are probable by the year 2000, according to Joseph Charyk, president of Comsat. Mr. Charyk further predicts that every large city will have its own satellite ground terminal (Bishop, 1966, p. 53).

The main impact of television via satellites will probably be in underdeveloped countries. Education via satellite is potentially the easiest and most powerful force toward modernization of underdeveloped countries (King-Hele, 1970, p. 69). There already exists

an international organization called Intelsat formed with the advent of communication satellites (Pierce, 1968, p. 57).

Will satellite broadcasting ever be received directly by individuals? David Sarnoff of RCA stated that the way is open technically for the establishment of a system by which anyone may establish contact with anyone, anywhere, at any time by voice, sight, or document, separately, or in combination (McHale, 1969, p. 146). However, many authorities such as Barnathan, vice-president of ABC television and Graham and Charyk of Comsat express reservations concerning this idea (Kettle, 1970, p. 100).

Some of the most intriguing future possibilities for communications lie in the development of using laser beams to transmit sounds and pictures. Laser light waves come in frequencies of trillions of cycles per second. A Bell laboratory report states that in only the visable portion of the laser there are million times more room for messages than in the entire range of frequencies we use for communications today (Bishop, 1966, p. 55).

Buckminster Fuller discusses the idea of a "laser-listener." He says a laser can convert an ordinary window into a microphone. Sound waves inside a room produce minute vibrations in window glass. A receiver can turn the vibrations back into speech (Fuller, 1970, p. 56B).

Don Fabun stresses the importance and impact of the technology of communications:

> . . . to communicate with someone is to effect some form of change in their store of experiences. This change may effect their level of perception, their way of seeing things, their information banks and even their pattern of behavior (Fabun, 1971, p. 188).

VI. ROLE OF COMPUTERS

What has always made machines truly important to man is the fact that they serve as agents of social change. The Industrial Revolution was called a "revolution" because it created a new environment and way of life for man. Yet today we are dealing with machines that can change society more profoundly and rapidly than the machines of the eighteenth and nineteenth centuries. Diebold points out that today's machines deal with the stuff society is made of, information and its communication (Diebold, 1969, p. 4).

Technological advances have been on a continuous upswing. "Half the scientific research conducted in the United States since the Republic was founded has been crowded into approximately the last eight years. Ninety precent of all scientists who have ever lived in the history of mankind are alive today" (Diebold, 1969, p. 7).

At the center of the technological revolution is the newly found ability to build information systems. The computer industry while relatively new has become a central factor in operations of our economy. Computers will increase the productivity level in offices and factories. They will store vast amounts of information about law, science, medicine and other fields, with access to any data available to thousands of people via teletypewriter links. They will allow lightning solutions to seemingly insoluble scientific and technological problems. There are also underway, machines to follow spoken instruction (Penn, 1966, p. 37).

Thus the computer has increased in its usage power. It has also increased in numbers. It is estimated that by the turn of the

century over 220,000 computers will be in operation. With growth, computers will be cheaper. It is estimated that by 1980's a computer with the capacity to store one million characters will rent for ten cents per month. Time sharing of computers will allow several people to use the same computer system simultaneously. General Electric already has this service in effect in New York City (Theobald, 1967, p. 14).

Some computer makers predict a new system of credit. A computer network will replace cash and checks. A bank computer acting as the heart of the system will be connected to community homes, stores, utilities, employers and other banks. This would enable people to live in a community without ever actually exchanging cash or checks. Transfer of funds would be relayed over computer wires. The Bank of Delaware has been participating in a pilot program with a chain of four shoe stores (Penn, 1966, p. 40).

Buckminster Fuller in I Seem To Be a Verb says that your thumb may be the only credit card needed. Computers will identify prints and people will be able to charge anywhere (Fuller, 1970, p. 154B).

If we believe computer enthusiasts, each country will have a central machine complex for storing up-to-date information on subjects. Everyone at home will have a keyboard for gaining access to information in the central computers. This central knowledge bank would be an extension and combination of the library, newspaper, weather station, etc. One limitation to absorbing knowledge would be similar to that involved in reading pages upon pages of microfilm. Thinking on a more

sinister line, personal information about everyone in a country or in the world could be a reality (King-Hele, 1970, p. 73).

Computers with international translating abilities could make strides in international communications. This area seems extremely difficult. According to Philip Abelson, editor of Science magazine, efforts to translate Russian to English have proven disappointing. It took about four times as long to decipher the broken English coming from the machine as to translate the Russian to begin with (Abelson, 1968, p. 62).

In the area of verbal communication attempts have been made in programming computers with an "understanding" of a particular area of human thought or activity. Thus we may have computers that can talk about mountain climbing but register a blank when asked about another area. J. R. Pierce, Executive Director of Research Communications Sciences Division of Bell Telephone Laboratories, felt that computers are unlikely to replace human linguistic abilities (Pierce, 1968, p. 52).

The Stanford Artificial Intelligence Project of the Computer Science Department is working in the area of seeing how far we can go in making computers do intellectual work. They have an extensive program in eye-hand manipulation. This program is a first step toward a long range goal of being able to make computers do useful work that involves seeing the world and manipulating it. This process would allow computers to perform such tasks as driving cars and automatically constructing houses (McCarthy, 1970, p. 108).

Some computers can be programmed to learn. In an article in Science magazine, Norbert Wiener, who coined the word "cybernetics," said:

> . . . in checkers they [computers] can show a marked superiority to the player who has programmed them after from ten to twenty playing hours of working and indoctrination. . . . they do unquestionably . . . show originality, not merely in their tactics, which may be quite unforeseen, but even in detailed weighting of their strategy (Wiener, 1960, p. 1356).

Computers could be valuable in the home also, according to Meredith Wooldridge Thring, professor of mechanical engineering at Queen Mary College in London, robots will be available within ten to twenty years' time to eliminate all routine operations around the house. There need be no more scrubbing floors, washing clothes, dusting, sweeping or making beds. A robot slave could be programmed to carry out all such standard operations (Kahn and Wiener, 1967, p. 94).

The field of law enforcement could also benefit from computers. License plates of automobiles written in computer alphabet could be read by television cameras. This could be useful in traffic flow planning and crime detection. High speed computers could also be used to scan telephone conversations for key phrases such as "kill," "infiltrate," "subvert," or more sophisticated combinations. Some computers may be able to apply a degree of inferential logic thus becoming transistorized Sherlock Holmes (Kahn and Wiener, 1967, p. 98).

The possibilities of computer aid for designers are many. Clothing designers use computers to scale designs for people of all

heights and proportions. Textile manufacturers can create new weave patterns from the computer's memory of existing weave patterns. Not only have clothing manufacturers found computers helpful but users as diverse as Boeing, General Motors, U. S. Navy, ITE Circuit Breaker have received help from computer design capabilities. Computers answer the important question, "If I do this, what will happen?" (Kettle, 1970, p. 200).

Leland Hazard, as did John Diebold, also points to the computer technology as an instrument of social change. He says the computer will result in the downgrading of: self-reliance, ability, privacy, freedom from interference, patriotism, prudence and human dignity. However, it will upgrade: physical well-being, economic security, friendship, intelligence, law and order, culture, peace and internationalism.

VII. SOURCES OF ENERGY

Many forms of energy man uses today were virtually unknown 150 years ago. These forms were not invented; they were discovered through the heightened awareness on the part of a few gifted men. It is possible that forms of energy wholly unknown will be discovered and put to practical uses before the end of the century (Fabun, 1971, p. 94).

How much energy will be available to us and in what forms fifty years from now? William Hartley in Here Comes Tomorrow said Americans are likely to be using three times as much energy by the end of the century as they are using today. Part of this increase is due to the

anticipated 70 percent rise in population. But most of it will result from increased per-capita use of power (Hartley, 1966, p. 60).

How far off is the day when fossil fuels will be all gone? Researchers say the Earth still holds enough of the fossil fuels, coal, oil and gas, to keep the nation going for centuries. Betrand de Jouvenal calls our civilization an incendiary civilization. He points out that if we relied on burning wood for expenditure of energy that it would take three years to burn up all the forests of the world. Reserves of oil at present consumption levels could last sixty years. While coal represents no less than 600 years of present consumption (Jouvenal, 1969, p. 299). Thus despite the surge in demand for energy, the supply is expected to be ample. Moreover, energy will cost less due to more efficient methods of producing it.

However, long before fossil fuels give out man may choose to turn to other forms of raw energy. Buckminster Fuller has recommended using energy sources in water and tides, wind and sun. We don't have to dig these up. They are free. The wind was one of the first non-biological sources of energy to be used by man. Even today windmills are sources of power. Technologically the wind is still a pioneer as an energy source. A hurricane, cyclone, tornado, or typhoon releases as much energy as a hydrogen bomb. Yet this source is untapped (Fabun, 1971, p. 104).

Like the winds water could further serve as an important source as electrical energy. The world's natural waterfalls or waterfalls made by man provide a power potential. The World Power Conference

estimated the world's hydro potential as five-trillion kilowatt-hours, although the theoretical power in the world's river flow is fifty-five times as great (Kettle, 1970, p. 118).

Tidal power is equally free and available. The world's tidal power has been estimated at twice the hydro potential or about the amount of electricity that the world uses today. The French have completed a tidal project harvesting the energy from a forty-four foot tidal differential in the English Channel. Other opportunities exist in Norway, Australia and New Zealand (Fabun, 1971, p. 104).

In talking about energy sometimes we overlook a very obvious source, the sun. Methods for utilizing solar energy have received much attention. The annual solar radiation received by the Earth is about 35,000 times our present yearly energy consumption. Every two days the sunlight provides enough energy in the United States to outlast all remaining fossil fuel reserves (McHale, 1969, p. 214). Solar energy can be used as heat or changed into electricity. Bell Telephone scientists are converting sunlight to solar energy. This has implications for residential heating use. But the most promising area is aerospace work. The solar cell has made possible much of the space exploratory data collected so far. In the future solar energy may power the entire satellite-routed global telecommunications system (Fabun, 1971, p. 93.)

Ultimately there will be almost limitless supplies of power from nuclear plants. Some scientists believe that nuclear fusion will be achieved within a decade. Since one pound of fissionable uranium is

equivalent in energy to about 650 tons of coal, its energy production is much greater than from any of the fossil fuels. Its advantages according to John McHale are:

> It can function anywhere. It is independent of geography, climate and general cultural level of the inhabitants. Upkeep is minimal. . . . Needed amounts of fuel are easily transported and the consumed weight is neglible. Operation is automatic and can be managed with limited personnel. . . . The plants can be placed where they are needed (McHale, 1969, p. 215).

Something like 90 percent of the generating stations on the drawing board are nuclear. And that is where they may stay, on the drawing boards. The general public will have to be convinced of the safety of such installations. In the minds of many people, nuclear energy is equated with The Bomb. Another problem is radiation contamination and disposal of wastes. Thermal pollution resulting in ecological disturbance is shouted by many. Other directions although still nuclear in nature are the "fast breeder reactor" and the "fusion" process in thermonuclear energy (Fabun, 1971, p. 102).

> The world stands unaware on the edge of an era when energy resources will be boundless. For the customer this heralds a time when the amount of electricity he uses may make no difference in his bill; he may pay only a flat rate for the peak demand he makes in any one year (Kettle, 1970, p. 127).

VIII. WEAPON TECHNOLOGY FOR WAR

On July 16, 1960, the world entered the sixteenth year of the nuclear era. Yet, as Herman Kahn reminds us that even after living with nuclear bombs for fifteen years we still have a great deal to learn about the possible effects of a nuclear war (Kahn, 1961, p. 551).

The powers of nuclear bombs are reasonably well established. The first atomic bomb had an explosive power equal to 20,000 tons of a high explosive such as TNT. The hydrogen bomb had a thousand times more power than the atomic bomb and was five times more powerful than all explosives used throughout the entire Second World War. Bombs with an explosive power much greater than twenty megatons are feasible, but do not seem desirable. A twenty megaton bomb would obliterate any city smaller than London. Thus a 100 megaton bomb would be wasteful "overkill" (King-Hele, 1970, p. 14).

A twenty megaton bomb would kill everyone within fifteen miles and many more further away. The shock effect compared to TNT would be one million times stronger. In a city like London five million people would be killed and 500 square miles totally devastated. The heat effect would leave an aftermath of blindness. The bomb would create a fire storm outside the area of complete destruction and leave a cloud of radioactive debris. The fallout would circle the stratosphere and be dangerous for years (Chase, 1968, p. 152).

According to Itheiel de Sola Pool, a member of the American Academy's Commission on the Year 2000, nuclear proliferation will spread: India in 1975, Pakistan in 1980; Egypt and Israel in 1983; Germany in 1985; Japan in 1990; and Algeria in 1995 (Pool, 1967, p. 322). Theodore Gordon in The Future would refer to this movement as the Nth Power problem, acquisition of atomic weapons by nations or blocs other than the United States, Great Britain, and the Soviet Union. The more nuclear powers the greater the possibility of nuclear

war (Gordon, 1965, p. 41). However, Kahn on his 1965 technology table refers to "limits on bomb technology." He feels that improvements concerning explosive power per unit of weight have leveled off. (Kahn and Wiener, 1967, p. 80).

It is likely that the main efforts in nuclear weapons for major powers between 1968 and 2018 will be in small nuclear weapons. These would include; short-range missiles, torpedoes, mines, bombs carried by fighter planes and efficiency of small and lightweight weapons. (Brennan, 1968, p. 8).

The missile era started in 1959 with the first intercontinental ballistic missile, the Atlas. By early 1960's the United States was well into the missile era. The Minuteman, Poseidon and Titan appeared on the scene. Antimissile systems like Nike-X appeared. Dispersal of missiles became an important factor. They were embedded in the ground, placed aboard submarines. The idea of putting advanced ICBM's on railroad flatcars, trucks or canal barges was considered. Another idea was to sink missiles in capsules under the sea to be fired by a remote control firing mechanism. The moon was also considered as a missile site. Maybe not so fanciful would be MOL's, manned orbiting laboratories. These could serve as launching platforms for missiles (Taylor, 1966, p. 190).

Among the crop of silent post-atomic weapons are chemical and biological weapons. In 1966 some 5,000 scientists including seventeen Nobelists signed this statement to President Johnson:

> Chemical and biological weapons have the potential of inflicting, especially on civilians, enormous devastation and death, which may be unpredictable in scope and intensity.

> They could become far easier to produce than nuclear weapons. . . they lend themselves to use by leadership that may be desperate, irresponsible or unscrupulous. . . United States forces have begun the large-scale use of anti-crop and "non-lethal" anti-personnel chemical weapons in Vietnam. We believe that this sets a dangerous precedent, with long-term hazards far outweighing any short-term military advantage. (Chase, 1968, p. 150).

A RAND Long Range Forecasting Study forecast the arrival of incapacitating chemical and biological agents. Experimentation with these agents showed an ability to produce cowardice (Gordon, 1969, p. 165). Buckminster Fuller points out that synthetic sex attractants have been used as biological weapons to lure beetles to their doom (Fuller, 1970, p. 59A). Poison gases, spreading of plagues, death rays and even mass hypnosis are reported to be in active development (Chase, 1968, p. 150).

New lasers, which concentrate light waves, bring to mind the "death ray" popularized by H. G. Wells. Many military applications of the laser are underway. The laser can provide a brightness about eight orders of magnitude greater than that of the sun. This has proven useful in target illumination, tracking and radar. A laser rifle could blind an enemy in combat and might kill him. It could also touch off explosives or set fire to wood. Brennan, a member of the Hudson Institute, says it is safe to predict that the laser will be one of the main military items in 2018 (Brennan, 1968, p. 10).

Herman Kahn postulates the claim that every five years there is a revolution in the technology of war. By the year 2000 there will be six more revolutions. Thus there would be an incredible menu of weapon systems to choose from (Kahn and Wiener, 1967, p. 80).

Manipulation of the enemy's environment might be possible. Dr. Walter Orr Roberts, past president of the American Association for the Advancement of Science, speaks of manipulating weather as a weapon of war. Hurricanes could be sent against naval fleets. Storms could pin down enemy aircraft. Famines could be induced or floods could destroy (Toffler, 1970, p. 191).

Sea and space could provide future battlegrounds. Rockets, air cushion vessels, super-speed submarines operating with a depth capability of 20,000 feet are some of the possible developments. Antigravity belts, rocket belts, space systems and disintegrator rays could add to the field (Brennan, 1968, p. 11).

The eight-thousand-year history of civilization is a continuum of war. As Will Durant said:

> As for wars, well, there's only been 268 years out of the last 3421 in which there was no war. So war, too, is in the normal course of events (Fuller, 1970, p. 18A).

IX. EXPLORATIONS IN SPACE

"By the year 2000 we will undoubtedly have a sizeable operation on the moon, we will have achieved a manned Mars landing and it's entirely possible we will have flown with men to outer planets," forecasts the famed rocket expert Wernher von Braun (Spivak, 1966, p. 87). Other scientists and engineers involved in the United States space program express similar views. However, tough technical problems remain to be solved before all of these objectives can be reached. Equipment such as radio transmitters, rockets and electronic parts must last in a reliable fashion for a period of years rather than

merely months. The damaging effects of high temperatures and vacuums must be considered in strengthening the structure of the space crafts. Astronauts must learn to endure the psychological stresses involved on long trips. The biological factor of weightlessness still causes problems. Advancement must occur in the field of nuclear rockets in order to propel spacecraft to the planets (Spivak, 1966, p. 88).

Large satellites in orbit around the earth will serve many purposes. They will act as sources of observation, as training stations and research laboratories. Weather forecasting and control will be areas of primary importance. Training in space operations, logistics and low gravity will take place there. Space-based meteorological studies dealing in long range forecasting could provide large economic benefits. It has been estimated that in the United States alone two billion dollars could be saved annually by farmers, fuel producers and public utilities if two week forecasts were available. Satellites could also be valuable in planning economic development. In conjunction with a computer a satellite could produce a resource map of certain areas. Capabilities of this kind could also be applied to management of agricultural resources and near surface mineral deposits, fisheries and water resources. These observations of plankton distribution, diseased orchards, crop growth patterns could add materially to the earth's food production. National disasters could be alleviated by satellite warnings. For example, upon spotting a fire in a large forest the weather satellite could determine humidity, direction and speed of wind and other variables

thus enabling better methods of bringing the fire under control (MacDonald, 1968, p. 31).

Many people think of space travel as the most exciting and remarkable thing to have happened in their lifetime. Yet, how quickly we have become used to it. Already items are relegated to page twenty-one in the newspaper and people are no longer glued in awe to their television sets. Yet space programs will continue for reasons of national security, demonstration of technological preeminence, economic stimulation, scientific curiosity and the direct contributions which can be made to man's life through orbital observations (Gordon, 1969, p. 186).

What does the lunar area hold for man? One obvious field is astronomy. Arthur C. Clarke describes the moon as a perfect base for astronomical observation. It has perfect visibility because it has no weather. It also has a low gravity so that very large structures could be built. The far side of the moon is shielded from all electronic racket of the earth, making an ideal site for large radio observatories. One assignment could be listening for high-frequency radio signals coming from beyond our solar system (Clarke, 1968, p. 251).

There is little doubt that we will set up semi-permanent research stations on the moon. At first they may be buried huts. The research stations could be ideal testing places for further exploration, due to the moon having only a sixth of the earth's gravity and a quarter of its radius it will be twenty-five times easier to launch expeditions from the moon than the earth. Experiments can be

conducted there which can only be imperfectly simulated on earth such as high vacuum, low gravity and full solar radiation. Efforts will be made to turn lunar rocks into food. Studies will be continued into the origin of the earth's formation and in studying rudimentary life-like molecules (Clarke, 1968, p. 251).

The moon base will some day be a city. One reason for this is its capability of becoming the launching pad for interplanetary missions. Its low gravity may make it an ideal sanitarium for heart and stroke patients. Food can be produced on the moon by hydroponic gardening. This would supply products to equip interplanetary voyages. Thus the moon becomes a grand launching base, a research center and a supplier of space vehicle products (Gordon, 1965, p. 160).

Mars is still the most fascinating target. Manned landing is projected for 1980's. The spaceships developed for Mars and Venus will serve as building blocks for more ambitious missions to distant planets. The atmosphere on Mars is tenuous. It has very little oxygen and water vapor yet it is much richer in nitrogen and carbon dioxide than the earth's atmosphere. The gaseous raw materials might make Mars a better colony than the moon. The day may come when man may need some living room. Mars will probably be the most hospitable planet for our overflow. Another possible value may be the raw materials available. It could become a granary for earth. Or it might provide a place for dumping our radioactive wastes. Gordon in The Future added the possibility of the world's penal institution (Clarke, 1968, p. 253).

Perhaps the most exciting and disturbing event in humanity's future will be contact with extraterrestrial intelligence. Our technological advances, our drives to explore, and our innate curiosity are impelling us toward this contact (Michaud, 1973, p. 71). John Kettle says that rational minds tell us that it is highly immodest to suppose that we are the only creatures there are. Yet, no astronomer, no physicist, and no other scientist has ever produced a suggestion of physical evidence for life on other planets, in or out of the solar system (Kettle, 1970, p. 239). Arthur C. Clarke agrees by saying that the solar system looks very unpromising as of now but pads himself by adding that we should always be prepared for surprises (Clarke, 1968, p. 254).

Several types of life detection systems have been suggested: remote control arm gathering samples, television cameras scanning areas, or microphones to listen. Theodore Gordon, Director of Space Stations and Planetary Systems at Douglas Aircraft Company, points out the importance of making sure the spacecraft itself does not bring the life with it in the form of earth life. This could be damaging to indigenous life forms. As the past has pointed out, we seem to have a history of bringing our infectious diseases with us on explorations. Back-contamination is another problem. The possibility that a spacecraft or returning astronaut will bring back an organism harmful to life on earth is feared by many. Some eminent biologists and scientists stated their fears in an excerpt of a report:

> The introduction into the earth's biosphere of destructive alien organisms could be a disaster of enormous significance

> to mankind. We can conceive of no more tragically ironic consequences of our search for extraterrestrial life.
> . . . . . .
> . . In a different environment, adaptation of the extra-terrestrial organism may take a different turn--illustrated by the observation that the virulence of many micro-organisms for a particular host can be greatly increased by successive passages through this host. Therefore, it seems conceivable that originally harmless forms of extra-terrestrial life may on earth acquire pathogenic characteristics. Such potentiality will be hard to judge when the organisms are first encountered.

Scientists have suggested that any material or astronauts returning from an alien environment be subjected to quarantine. This might be another role of the lunar base or perhaps an orbiting space station could fill the same need (Gordon, 1965, p. 167).

Sitting in 1973, one cannot expect that his picture of 1999 will be accurate. It would be advisable to hope something close to opposite would be true. For in the intervening years the processes of imagination and creation will lead one to change his imagination. Hopefully, the process as it continues will engage wholly new people with new images that were not imagined by the ones who began the process. One should expect to move in the direction of the image but never to it. Hopefully new and better ideas would intervene thus changing the direction. Arthur Waskow in an article entitled, "Looking Forward: 1999," compared this idea to a scientific process:

> Hypothesis, experiment, new hypothesis--always knowing that no theory is "The Truth," but only a useful way of understanding and reshaping the complex reality (Waskow, 1969, p. 80).

Thus one never fully arrives. The process continuously has an open end keeping the future free to always contemplate its own future.

CHAPTER III

PRESENTATION OF DATA

The purpose of this study was to formulate the general content area for a course in Futuristics for the eleventh grade student in Knox County high schools. A consideration of the recurrent technological concerns of futuristic writers and the needs of the curriculum as concluded from a survey of eleventh grade students, parents, teachers and administrators of the seven Knox County high schools were procedures used for gathering the data.

I. ORGANIZATON AND PRESENTATION OF SURVEY

The process of gathering information related to the above purposes was accomplished through the use of four surveys. These four surveys were in the form of questionnaires. The questionnaires were constructed by the investigator. The questionnaires consisted of nine topics having the greatest frequency of occurrence in the review of the literature. The respondents were asked to indicate on a scale from essential to no opinion their position on each topic. The population for this study consisted of eleventh grade students, parents, teachers and administrators. A sample was drawn at random for each of the four groups of respondents from the seven Knox County high schools: Karns, Gibbs, Carter, Halls, Powell, Farragut and Doyle. The total population of these four respondent groups was 3,864. A sample was drawn at random consisting of 417 eleventh grade students

and parents, 286 teachers and 43 administrators. One thousand one hundred sixty-three questionnaires were distributed and 870, or 75 percent, were returned.

II. DISCUSSION OF DATA

The questionnaire (Appendix D) consisted of nine topics designed to help identify the most desirable content for an eleventh grade elective course in Futuristics. The data gathered from this questionnaire are discussed by analyzing how students, parents, teachers and administrators responded to these nine topics.

Advancements in Biology

As can be seen in Table I, showing responses from the total survey group, the desirable category with 39.9 percent was the highest percentage shown for any category on this topic. The highest response from eleventh grade students was also the desirable category with 39.3 percent, as shown in Table II. This is the highest percentage response for any category from eleventh grade students. Table III shows parents also responding with the highest percent, 38.5 in the desirable category. Teachers, in Table IV, answered similarly, giving the desirable category the highest percentage from all groups of 43.8 percent. Administrators deviate from the pattern by giving a rating of 44.2 percent to the category, of some importance, as shown in Table V.

Sources of Food

The highest percentage response category from the total group for this topic was the essential category receiving 39.3 percent shown

TABLE I

RESPONSES FROM TOTAL GROUP ON QUESTIONNAIRE CONCERNING TECHNOLOGICAL TOPICS FOR AN ELEVENTH GRADE COURSE IN FUTURISTICS

	Categories													
	Essential		Desirable		Of Some Importance		Of No Importance		No Opinion		No Answer		Total	
Topics	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %
Advancements in Biology	206	23.7	347	39.9	242	27.8	25	2.9	49	5.6	1	0.1	870	100.0
Sources of Food	342	39.3	313	36.0	150	17.2	28	3.2	35	4.0	2	0.2	870	100.0
Development of Cities	212	24.4	302	34.7	246	28.3	56	6.4	48	5.5	6	0.7	870	100.0
Modes of Transportation	287	33.0	320	36.8	207	23.8	17	2.0	37	4.3	2	0.2	870	100.0
Advances in Communications	270	31.0	375	43.1	176	20.2	14	1.6	33	3.8	2	0.2	870	100.0
Role of Computers	235	27.0	321	36.9	242	27.8	29	3.3	34	3.9	9	1.0	870	100.0
Sources of Energy	503	57.8	236	27.1	95	10.9	8	0.9	15	1.7	13	1.5	870	100.0
Weapon Technology for War	147	16.9	237	27.2	293	33.7	114	13.1	65	7.5	14	1.6	870	100.0
Exploration in Space	130	14.9	343	39.4	257	29.5	75	8.6	49	5.6	16	1.8	870	100.0

TABLE II

RESPONSES FROM STUDENTS ON QUESTIONNAIRE CONCERNING TECHNOLOGICAL TOPICS FOR AN ELEVENTH GRADE COURSE IN FUTURISTICS

	Categories													
	Essential		Desirable		Of Some Importance		Of No Importance		No Opinion		No Answer		Total	
Topics	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %
Advancements in Biology	68	21.4	125	39.3	93	29.2	13	4.1	18	5.7	1	0.3	318	100.0
Sources of Food	92	28.9	95	29.9	92	28.9	15	4.7	23	7.2	1	0.2	318	100.0
Development of Cities	67	21.1	101	31.8	95	29.9	23	7.2	29	9.1	3	0.9	318	100.0
Modes of Transportation	102	32.1	93	29.2	91	28.6	15	4.7	16	5.0	1	0.3	318	100.0
Advances in Communications	89	28.0	122	38.4	74	23.3	13	4.1	19	6.0	1	0.3	318	100.0
Role of Computers	68	21.4	93	29.2	114	35.8	19	6.0	18	5.7	6	1.9	318	100.0
Sources of Energy	166	52.2	83	26.1	49	15.4	6	1.9	7	2.2	7	2.2	318	100.0
Weapon Technology for War	56	17.6	76	23.9	103	32.4	50	15.7	27	8.5	6	1.9	318	100.0
Exploration in Space	49	15.4	117	36.8	90	28.3	31	9.7	24	7.5	7	2.2	318	100.0

TABLE III

RESPONSES FROM PARENTS ON QUESTIONNAIRE CONCERNING TECHNOLOGICAL TOPICS FOR AN ELEVENTH GRADE COURSE IN FUTURISTICS

	Categories													
	Essential		Desirable		Of Some Importance		Of No Importance		No Opinion		No Answer		Total	
Topics	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %
Advancements in Biology	69	21.8	122	38.5	92	29.0	9	2.8	25	7.9	0	0.0	317	100.0
Sources of Food	137	43.2	115	36.3	43	13.6	11	3.5	11	3.5	0	0.0	317	100.0
Development of Cities	70	22.1	108	34.1	97	30.6	25	7.9	14	4.4	3	0.9	317	100.0
Modes of Transportation	100	31.5	122	38.5	77	24.3	2	0.6	15	4.7	1	0.3	317	100.0
Advances in Communications	87	27.4	148	46.7	67	21.1	1	0.3	13	4.1	1	0.3	317	100.0
Role of Computers	87	27.4	114	36.0	89	28.1	9	2.8	16	5.0	2	0.6	317	100.0
Sources of Energy	184	58.0	89	28.1	31	9.8	2	0.6	7	2.2	4	1.3	317	100.0
Weapon Technology for War	50	15.8	80	25.2	98	30.9	53	16.7	30	9.5	6	1.9	317	100.0
Exploration in Space	34	10.7	118	37.2	99	31.2	36	11.4	23	7.3	7	2.2	317	100.0

TABLE IV

RESPONSES FROM TEACHERS ON QUESTIONNAIRE CONCERNING TECHNOLOGICAL TOPICS FOR AN ELEVENTH GRADE COURSE IN FUTURISTICS

Topics	Categories													
	Essential		Desirable		Of Some Importance		Of No Importance		No Opinion		No Answer		Total	
	Abs. Freq.	Rel Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %
Advancements in Biology	61	31.8	84	43.8	38	19.8	3	1.6	6	3.1	0	0.0	192	100.0
Sources of Food	86	44.8	89	46.4	13	6.8	2	1.0	1	0.5	1	0.5	192	100.0
Development of Cities	59	30.7	74	38.5	48	25.0	6	3.1	5	2.6	0	0.0	192	100.0
Modes of Transportation	68	35.4	85	44.3	34	17.7	0	0.0	5	2.6	0	0.0	192	100.0
Advances in Communications	75	39.1	88	45.8	29	15.1	0	0.0	0	0.0	0	0.0	192	100.0
Role of Computers	60	31.3	96	50.0	34	17.7	1	0.5	0	0.0	1	0.5	192	100.0
Sources of Energy	124	64.6	55	28.6	11	5.7	0	0.0	0	0.0	2	1.0	192	100.0
Weapon Technology for War	36	18.8	64	33.3	74	38.5	11	5.7	5	2.6	2	1.0	192	100.0
Exploration in Space	41	21.4	90	46.9	49	25.5	8	4.2	2	1.0	2	1.0	192	100.0

TABLE V

RESPONSES FROM ADMINISTRATORS ON QUESTIONNAIRE CONCERNING TECHNOLOGICAL TOPICS FOR AN ELEVENTH GRADE COURSE IN FUTURISTICS

	Categories													
	Essential		Desirable		Of Some Importance		Of No Importance		No Opinion		No Answer		Total	
Topics	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %	Abs. Freq.	Rel. Freq. %
Advancements in Biology	8	18.6	16	37.2	19	44.2	0	0.0	0	0.0	0	0.0	43	100.0
Sources of Food	27	62.8	14	32.6	2	4.7	0	0.0	0	0.0	0	0.0	43	100.0
Development of Cities	16	37.2	19	44.2	6	14.0	2	4.7	0	0.0	0	0.0	43	100.0
Modes of Transportation	17	39.5	20	46.5	5	11.6	0	0.0	1	2.3	0	0.0	43	100.0
Advances in Communications	19	44.2	17	39.5	6	14.0	0	0.0	1	2.3	0	0.0	43	100.0
Role of Computers	20	46.5	18	41.9	5	11.6	0	0.0	0	0.0	0	0.0	43	100.0
Sources of Energy	29	67.4	9	20.9	4	9.3	0	0.0	1	2.3	0	0.0	43	100.0
Weapon Technology for War	5	11.6	17	39.5	18	41.9	0	0.0	3	7.0	0	0.0	43	100.0
Exploration in Space	6	14.0	18	41.9	19	44.2	0	0.0	0	0.0	0	0.0	43	100.0

in Table I. Student response, as shown in Table II, gives desirable as the category receiving the highest percent response with 29.9 percent. In Table III, parents agree with the total group by giving the category of essential 43.2 percent as their response. Teachers, as shown in Table IV, agree with the students by giving the desirable category the highest response percentage of 46.4. In Table V, the highest percentage of any group response is shown by the administrator's response of 62.8 percent in the essential category.

Development of Cities

The highest response category from the total group for this topic shown in Table I was desirable receiving 37.4 percent. All groups of respondents agreed with the highest response of desirable. In Table II, students responded with 31.8 percent. In Table III, parents responded with 34.1 percent. Teachers responded in Table IV with 38.5 percent. Administrators, in Table V, gave the largest percentage of response to the desirable category with 44.2 percent.

Modes of Transportation

All groups of respondents with the exception of students agreed with the total group response of the category desirable. The percentage of desirable category as shown in Table I for the total group was 36.8. The student group deviated by choosing the essential category with 32.1 percent shown in Table II. In Table III, the parents chose the desirable category with 38.5 percent response. The teachers answered similarly showing a percent of 44.3 for the desirable category in Table IV. The administrators also chose the desirable category with a response of 46.5 percent shown in Table V.

Advances in Communications

The highest total group response category shown in Table I was the desirable category receiving 43.1 percent. All groups of respondents with the exception of administrators agreed with this response category. The students, as shown in Table II, gave 38.4 percent to the response of desirable. In Table III, the parents also chose the category of desirable with a response of 46.7 percent. This is the highest percentage of response for the category of desirable that the parents gave to any of the nine topics. The teachers agree with the parents and students. In Table IV, they show a response of 45.8 percent for the desirable category. In Table V, the administrators give the highest percentage of response to the essential category with 44.2 percent.

Role of Computers

The total group response receiving the highest percentage as shown in Table I for this topic was the desirable category with 36.9 percent. However, this topic shows more deviation in response than the five previously mentioned topics. In Table II, the student response was highest in the category of some importance with 35.8 percent. This response represents the highest percentage for the category of some importance that the students gave to any topic. The parents showed the highest percentage of response in the category of desirable with 36.0 percent in Table III. In Table IV, the teachers gave a percent of 50.0 to the category of desirable. This response represents the highest percentage for the category of desirable that the teachers

gave to any topic. The administrators in Table V gave the topic the highest rating by responding with a 46.5 percent in the essential category.

Sources of Energy

As shown in Table I, this topic received the highest percentage of response in the essential category with 57.8 percent. This percentage represents the highest total response for any category of the nine topics. All groups of respondents answered similarly by responding in the category of essential and giving this category of essential the highest percentage of response for any of the nine topics. In Table II, the students gave a response of 52.2 percent in the essential category. In Table III, the parents responded with 58.0 percent in the essential category. In Table IV the teachers also responded with the highest percentage in the essential category of 64.6 percent. Administrators, in Table V, completed the total group agreement by showing the highest percentage of response in the essential category with 67.4 percent.

Weapon Technology for War

The total group response, as shown in Table I, was highest in the category of some importance receiving 33.7 percent. Again, the entire group of respondents were in total agreement by each selecting the category of some importance as the category receiving the highest percentage of response. In Table II, the students gave 32.4 percent to the category of some importance. In Table III, the parents gave 30.9 percent to the category of some importance. Teachers, agreeing

with all other groups, gave a response of 38.5 percent to the category of some importance, as shown in Table IV. In Table V, the administrators answered similarly by giving a response of 41.9 percent to the category of some importance.

Exploration in Space

In Table I, the category receiving the highest percentage of response from the entire group of respondents was the desirable category with 39.4 percent. Students agreed with the total group response by also giving the highest percentage of 36.8 in the desirable category, as shown in Table II. In Table III the parents answered similarly by giving the highest percentage of response to the desirable category with 37.2 percent. As shown in Table IV, the teachers, agreeing with students and parents, gave 46.9 percentage of response to the desirable category. The administrators, deviating from the other groups of respondents gave the highest percentage of response in the category of some importance with 44.2 percent as shown in Table V.

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

I. SUMMARY

More futuristics courses are being organized each year. Most of these courses have been initiated at the local school level. This being the case, many of these courses, although similar in nature, vary somewhat in their content structure. It is desirable to structure courses according to the needs of the students in each unique area.

Specificially, the problem involved (1) identifying the major technological concerns in the writings of the "futurists," (2) relating these concerns to the needs of eleventh grade students in Knox County high schools and (3) formulating a general content area based on the findings of (1) and (2).

A search for literature revealed technological areas which seemed to be of major concern to futuristic writers. These areas of concentration were incorporated into a questionnaire containing nine major technological topics. The questionnaires were distributed to a random sample group of 1,163 respondents. This respondent group was composed of students, parents, teachers and administrators of the seven Knox County high schools.

II. CONCLUSIONS

An analysis of the data gathered from the questionnaires distributed to the random sample group of students, parents, teachers

and administrators of the seven Knox County high schools provided the basis for the following conclusion made in this section.

The total group gave the topics, Sources of Food and Sources of Energy, the highest ratings in the essential category. The topics, Weapon Technology for War and Exploration in Space, received the lowest ratings in the essential category. The remaining five topics; Advancements in Biology, Development of Cities, Modes of Transportation, Advances in Communications and Role of Computers, all received ratings of desirable. It appears that in constructing course content for this total group of Knox County school respondents all categories, with the possible exceptions of Weapon Technology for War and Exploration in Space, might be desirable.

The group of eleventh grade students chose the topics of Modes of Transportation and Sources of Energy as having the highest ratings in the essential category. It may be of significance in that many eleventh grade students receive driver's license at this time. This fact might cause a rise in their consciousness of transportation. The high response by the students for the topic Sources of Energy may be explained by the fact that this year, 1974, has been a year when nationwide attention has been focused on the depleting sources of energy and methods of conservation. The energy topic received the highest unanimous rating of all groups surveyed. As with the total group, the students appeared to feel that Weapon Technology for War and Exploration in Space were the least essential.

The parents gave the topics of Sources of Food and Sources of Energy as the topics receiving the highest rating in the essential

category. This year, 1974, has brought shortages in food products such as meats and fruits. Since parents are the members of families most associated with these needs, this recent food shortage may have influenced their high priority rating for food sources. As with the total group and students, the parents gave the lowest ratings of essential to Weapon Technology for War and Exploration in Space. This low rating in the topic of war technology may reflect the country's frustration with the long war in Vietnam. The rating may have also been affected by the citizens' attitudes for spending funds toward upgrading the quality of life in the United States and opposed to war.

The teachers responded highest in the essential category to the topics of Sources of Food, Advances in Communications, and Sources of Energy. Many teachers are also parents; therefore, their response to the need for sources of food might be the same as that of the parents. Teachers did add the topic of Advances in Communications which the students and parents omitted. Teachers may be more aware of the need for new methods and devices of communications considering the nature of their jobs. Teachers also gave the topics of Weapon Technology for War and Exploration in Space the lowest essential ratings. However, the teacher group did give the topic Exploration in Space a higher percentage rating than any of the other three groups. The low rating for the topic of space exploration may be due to the time lapse since the first manned lunar landing. Yet, teachers may feel that this topic should be considered due to their contact with the science and math emphasis in many schools.

The administrators gave the highest essential responses to the topics of Sources of Food, Advances in Communications, Role of Computers and Sources of Energy. Their attitudes might be parallel to those of teachers and parents concerning food, communications and energy. However, they did select the topic Role of Computers, as essential. The administrator group was the only group to give this topic such a high rating. As with teachers, the demands of their jobs and their familiarity with the advantages of computers may explain their high reaction to this topic. They too agree with all other groups by giving low essential ratings to the topics of Weapon Technology for War and Exploration in Space. They do add the topic of Advancements in Biology as another topic with a low essential rating. Perhaps administrators' perception of their role as being responsible for the instructional program may explain this low rating, since the topic of evolution has often been a debated topic in the state of Tennessee as well as the controversy of the proper place for sex education in the school program.

It appears that all respondents react to the topics according to their most urgent needs and the effect the topic has on their lives.

III. RECOMMENDATIONS

The following recommendations are provided, based on the findings obtained from this study:

1. Sources of Food and Sources of Energy are topics which should be considered as essentials in a course in Futuristics.

2. The topics, Modes of Transportation, Advances in Communications and the Role of Computers should be highly considered as course content.

3. The topics, Development of Cities, and Advancements in Biology, should be offered as alternatives to the course content in Futuristics.

4. Further research is desirable in order to determine the causes of the 13.2 percent difference between teachers and administrators in the essential category for the topic, Advancements in Biology.

5. Further research is desirable in order to determine the causes of the topics, Weapon Technology for War and Exploration in Space, appearing as the least desirable choices for all categories of respondents.

6. Further and continuous research is needed in order to determine how respondents in the future would rank in importance topics for a course in futuristics.

SELECTED BIBLIOGRAPHY

SELECTED BIBLIOGRAPHY

Abelson, P. "The Continuing Scientific Revolution," Man and the Future. Edited by James Gunn. Kansas: University Press of Kansas, 1968.

Beckwith, B. The Next 500 Years. New York: Exposition-University, 1967.

Bell, D. Toward the Year 2000. Boston: Houghton-Mifflin Co., 1968.

Bishop, J. "Communications: The World-Wide Hookup," Here Comes Tomorrow. Edited by Paul Lancaster. New Jersey: Dow-Jones, 1966.

Bray, T. "Food: Where Will It Come From," Here Comes Tomorrow. Edited by Paul Lancaster. New Jersey: Dow-Jones, 1966.

Brennan, D. "Weaponry," Toward the Year 2018. Edited by Foreign Policy Association. New York: Cowles Education Corporation, 1968.

Carley, W. "Medicine: More Healthy Years," Here Comes Tomorrow. Edited by Paul Lancaster. New Jersey: Dow-Jones, 1966.

Chase, S. The Most Probable World. New York: Harper and Row, 1968.

Clarke, A. "Explorations in Tomorrow," Man and the Future. Edited by James Gunn. Kansas: University Press of Kansas, 1968.

Cooke, R. "Air Travel: Faster and Easier," Here Comes Tomorrow. Edited by Paul Lancaster. New Jersey: Dow-Jones, 1966.

Diebold, J. Man and the Computer. New York: Frederick A. Praeger, 1969.

Erlich, P. The Population Bomb. New York: Ballantine Books, 1968.

Erlich, P. "Population and Environment," Toward Century 21. Edited by C. S. Wallia. New York: Basic Books, Inc., 1970.

Fabun, D. Dimensions of Change. California: Glencoe Press, 1971.

Fourastie, J. Les 40,000 Heures. Paris: Editions Laffont, 1965.

Fuller, B. "Prospects for Humanity," Man and the Future. Edited by James Gunn. Kansas: University Press of Kansas, 1968.

Fuller, B. I Seem To Be a Verb. New York: Bantam Books, 1970.

Gordon, T. The Future. New York: St. Martin's Press, 1965.

Gordon, T. "The Feedback Between Technology and Values," Values and the Future. Edited by Kurt Baier and Nicholas Rescher. New York: Free Press, 1969.

Halaby, N. "Transportation," Toward the Year 2018. Edited by Foreign Policy Association. New York: Cowles Education Corporation, 1968.

Hartley, W. "Energy: Doing the Work," Here Comes Tomorrow. Edited by Paul Lancaster. New Jersey: Dow-Jones, 1966.

Johnson, B. "Practical Preparation for the 21st Century," Phi Delta Kappan, 8, April, 1973.

Jouvenal, B. "Technology as a Means," Values and the Future. Edited by Kurt Baier and Nicholas Rescher. New York: Free Press, 1969.

Kahn, H. On Thermonuclear War. New Jersey: Princeton University Press, 1961.

Kahn, H. and A. Wiener. The Year 2000. New York: Macmillan Company, 1967.

Kettle, J. Footnotes on the Future. Toronto: Methuen Publications, 1970.

King James Version. Genesis 1:26. Philadelphia: National Publishing Company, 1958.

King-Hele, D. The End of the Twentieth Century? New York: St. Martin's Press, 1970.

Livingston, D. "Schooling Up for a Future with the Futurists," Media and Methods. March, 1973.

Lundberg, F. The Coming World Transformation. New York: Doubleday and Company, 1963.

MacDonald, G. "Space," Toward the Year 2018. Edited by Foreign Policy Association. New York: Cowles Education Corporation, 1968.

McCarthy, J. "The Thinking Computer," Toward Century 21. Edited by C. S. Wallia. New York: Basic Books, Inc., 1970.

McHale, J. The Future of the Future. New York: George Braziller, Inc., 1969.

Meier, R. "Material Resources," Mankind 2000. Editors, Robert Jungk and Johan Galtung. London: Allen and Unwin, 1969.

Michaelis, A. "Television from Space to Satellite," Mankind 2000. Editors, Robert Jungk and Johan Galtung. London: Allen and Unwin, 1969.

Michaud, M. "Negotiating with Other Worlds," The Futurist, April, 1973.

Papaioannou, J. "Some Highlights for A. D. 2000," Mankind 2000. Editors, Robert Jungk and Johan Galtung. London: Allen and Unwin, 1969.

Penn, S. "Computers, The Impersonal Genie," Here Comes Tomorrow. Edited by Paul Lancaster. New Jersey: Dow-Jones, 1966.

Perloff, H. "Moderninzing Urban Development," Toward the Year 2000. Edited by Daniel Bell. Boston: Houghton-Mifflin Company, 1968.

Pierce, J. "Communication," Toward the Year 2018. Edited by Foreign Policy Association. New York: Cowles Education Corporation, 1968.

Pool, I. "The International System in the Next Half Century," Toward Year 2000. Edited by Daniel Bell. Boston: Houghton-Mifflin Company, 1967.

Porter, F. How Man Can Live. New Jersey: Porter, 1971

Ruppenthal, K. "Future Transportation," Toward Century 21. Edited by C. S. Wallia. New York: Basic Books Incorporated, 1970.

Spivak, J. "Space: Men on Mars," Here Comes Tomorrow. Edited by Paul Lancaster, New Jersey: Dow-Jones, 1966.

Steinbuch, K. "Communication in the Year 2000," Mankind 2000. Editors, Robert Jungk and Johan Galtung. London: Allen and Unwin, 1969.

Stone, P. "Public Opinion in a Future Democratic Society," Toward Century 21. Basic Books, Incorporated, 1970.

Taylor, F. "War: Tomorrow's Arms," Here Comes Tomorrow. Edited by Paul Lancaster. New Jersey: Dow-Jones, 1966.

Theobald, R. "Dialogue-Focuser: The Impact of Technology," Dialogue on Technology. New York: Bobbs-Merrill Company, 1967.

Toffler, A. Future Shock. New York: Random House, 1970.

Torrey, E. "Ethical Issues in Future Medicine," Toward Century 21. Edited by C. S. Wallia. New York: Basic Books, Incorporated, 1970.

Vonk, H. "Education and the 27 Year Countdown," Phi Delta Kappan, 8, April, 1973.

Waskow, A. "Looking Forward: 1999," Mankind 2000. Editors, Robert Jungk and Johan Galtung. London: Allen and Unwin, 1969.

Wiener, N. "Some Moral and Technical Consequences of Automation," Science, Vol. 131, No. 3410, May, 1960.

APPENDICES

APPENDIX A

COVER LETTER FOR QUESTIONNAIRE

TO PARENTS

I am a teacher at Karns High School. I am working on my Master's thesis in Curriculum and Instruction at the University of Tennessee. My thesis concerns the topics that will serve as the content for a proposed elective course for eleventh grade students in Knox County high schools entitled "Futuristics."

I am sure that you are aware of the great changes in living that have occurred in your lifetime. Change will continue to be with us into the future. In order for your child to adapt into the future world, he needs to become aware of what posibilities may exist for the twenty-first century.

As a parent I feel that your opinion on the content of this proposed course is very important. Would you please complete the enclosed questionnaire and return it to me via your child as promptly as possible? No respondents' names will be identified in the results of this study. Your help in supplying this information will be greatly appreciated.

Yours sincerely,

Ann H. Bitzas

APPENDIX B

COVER LETTER FOR QUESTIONNAIRE

TO TEACHERS

I am working on my Master's thesis in Curriculum and Instruction at the University of Tennessee. My thesis deals with the content for a proposed elective futuristics course for the eleventh grade student in Knox County high schools.

The enclosed questionnaire is being used as my instrument for gathering opinions from students, parents, teachers and administrators as to the preferred content in this course.

Would you please take the time out of your very busy day to complete the enclosed questionnaire and return it to your English Department Head? No respondents' names will be identified in the results of this study. Your help in supplying this information will be greatly appreciated.

Yours sincerely,

Ann H. Bitzas

APPENDIX C

COVER LETTER FOR QUESTIONNAIRE

TO ADMINISTRATORS

I am employed by the Knox County School System as an English teacher at Karns High School. I am working on my Master's thesis in Curriculum and Instruction at the University of Tennessee. My thesis deals with the content for a proposed futuristics course of an elective nature for the eleventh grade student in Knox County high schools.

The enclosed questionnaire is being used as my instrument for gathering data in the form of opinions from students, parents, teachers, and administrators as to the preferred content in our immediate area for this proposed course.

Would you please take the time out of your very busy day to complete the enclosed questionnaire and return it to me via the enclosed stamped envelope? No respondents' names will be identified in the results of this study. Your help in supplying this information will be greatly appreciated.

Yours sincerely,

Ann H. Bitzas

APPENDIX D

QUESTIONNAIRE

TECHNOLOGICAL TOPICS FOR AN

ELEVENTH GRADE COURSE IN

FUTURISTICS

This survey concerns topics to be included in an elective course for eleventh graders entitled, "Futuristics." This course would enable high school students to learn more about the possibilities in various fields of technology that will affect their future lives.

Please fill out the following questionnaire concerning your opinions as to which categories would be of greatest importance in designing such a course. Please check the number of the desired category. Do not check the example topics. Check only the main topic name. Please check category applicable to you.

_____ 1. Student

_____ 2. Parent

_____ 3. Teacher

_____ 4. Administrator

These categories are defined as follows:

Essential.- The topic is a must.

Desirable. - The topic is desirable. It should be included.

Of Some Importance. - The topic may be included but it is not absolutely necessary.

Of No Importance. - The topic should not be included as content in the course.

No Opinion. - You may not have enough information about the topic to give any rating or you do not have any opinion as to whether that topic should be included in the course.

SAMPLE MARKING

	Essential	Desirable	Of Some Importance	Of No Importance	No Opinion
1. ADVANCEMENTS IN BIOLOGY					✓
Example Topics: transplants, brain-control, birth-technology					

	Essential	Desirable	Of Some Importance	Of No Importance	No Opinion
1. ADVANCEMENTS IN BIOLOGY					
Example Topics: transplants, brain-control, birth-technology					
2. SOURCES OF FOOD					
Example Topics: agriculture, ocean, synthetic foods					
3. DEVELOPMENT OF CITIES					
Example Topics: land areas, domed cities, sea cities, sky cities					
4. MODES OF TRANSPORTATION					
Example Topics: automobile, high speed trains, hovercraft, airplanes, rocketry					

	Essential	Desirable	Of Some Importance	Of No Importance	No Opinion
5. ADVANCES IN COMMUNICATIONS					
Example Topics: print computers television satellites laser beams					
6. ROLE OF COMPUTERS					
Example Topics: storing information giving information solving problems doing work					
7. SOURCES OF ENERGY					
Example Topics: coal, oil, gas water, wind, sun geyser nuclear					
8. WEAPON TECHNOLOGY FOR WAR					
Example Topics: nuclear bombs missiles chemical weapons biological weapons					
9. EXPLORATION IN SPACE					
Example Topics: satellites lunar area Mars other planets					

VITA

Ann H. Bitzas was born in Knoxville, Tennessee, on March 29, 1944. She attended elementary schools in that city and was graduated from Farragut High School in 1960. The following September she entered Carson-Newman College, and in August, 1963, she received a Bachelor of Arts Degree in English.

She has taught in the Knox County Public School System since 1963. She is currently teaching Latin, mythology and futuristics at Karns High School.

In August, 1973, she married George C. Bitzas, an associate professor of voice at The University of Tennessee.