SCIENCE EDUCATION IN AN AMISH MENNONITE COMMUNITY AND SCHOOL: AN EXAMINATION OF PERCEPTION AND APPLICATION

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Science Education in an Amish Mennonite Community and School: An Examination of Perception and Application
(Under the direction of J. STEVE OLIVER and JUDITH PREISSLE)

The purpose of the study is to show how science is defined and technology is selected in an Amish Mennonite (fundamentalist Christian) community and its school. Additionally, by examining this community, information is collected on how a fundamentalist school's treatment of and experience with science and technology compare to what has occurred over time in public schools in the United States.

An ethnographic approach was used to recreate the shared beliefs, practices, artifacts, folk knowledge, and behaviors of this community. The ethnographic methodology allowed analytical descriptions and reconstructions of whole cultural scenes and groups of the community.

Analysis of data followed an analytic induction method. The data collected included participant observation, documentation, photographs, formal interviews, informal interviews, audiotaping, journal entries, and artifacts.

Findings indicate that science is wholly subsumed by Amish Mennonite religion. Using the transmission model, the Amish Mennonites teach science as a list of facts from the King James version of the Holy Bible. This method of teaching promotes community values and beliefs.

The encouragement stands in sharp contrast to the Amish Mennonite school. Technology is seen as a tool for making the community prosper. For this community to sustain itself, economic stability must be maintained. Their economic stability is dependent on the outside community purchasing their goods and services; producing these goods and services requires use of appropriate technologies. In the United States public schools, science is encouraged to be taught a way of knowing that implies a critical view about how the world works. In addition, public schools promote new and innovative technologies. Thus, they

become fertile soil for developing new concepts about implementing scientific ideas and using technology. For the Amish Mennonites, rigorous standards, such as the scientific method, as addressed in the public school do not exist. In contrast, critical analysis of any new technology is always used in this community.

INDEX WORDS: Values, Beliefs, Science, Technology, Science Education, Anthropology, Ethnography, Amish Mennonites, Amish, Religion, Christianity, Fundamentalism, Analytic Induction.

DEDICATED TO:

Matthew Scott Crockett

John Andrew Crockett

&

Nancy S. King

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CHAPTER I

INTRODUCTION

This is a study of an Amish Mennonite community--a microculture I call the Oak Knoll Amish Mennonite community. Specifically I have collected information about how science is defined and technology is selected in the community and its school.

According to the 1990 United States census, individuals categorized themselves into 51 different ancestral groups, and 27 different languages were spoken in the nation's homes (U. S. Bureau of the Census, 1990). And yet ancestral ties and languages are just two of many factors that characterize the complexity of United States culture. Culture, taken in its wide ethnographic sense, is that complex set of characteristics that includes knowledge, belief, art, morals, laws, customs, and any other capabilities and habits acquired by humans as a member of society (Tylor, 1858). Similarly, Linton (1945) wrote that culture is an organized group of ideas, habits, and conditioned emotional responses shared by the members of a society. In either case, society and culture are always linked. For without culture, a group of individuals is not a society but an aggregate. Then what does culture not encompass? Anyone attending a baseball game sees thousands of people united by a common interest and reacting in unison to a stimulus, such as a hit that scores a run. However, when the game is over, the aggregate dissolves. No culture exists. Therefore, societies must exist together long enough to develop patterns methods of living and working together. The organization of all societies and the existence of any society as such depends on culture. Societies are made up of people whose cultures exist on a psychological and behavioral level, and both persist through time

and are self-perpetuating. This persistence of society and culture is based on the inculcation of individuals through learning. Even the structuring of society is an aspect of culture, because society is composed of positions occupied by a series of successful individuals or groups of individuals (Linton, 1945). Any community, even a small religious community such as the Oak Knoll Amish Mennonites discussed in this study, contains these elements of culture. The perpetuation of these elements allows the Oak Knoll Amish Mennonites to continue to thrive.

Culture, worldview, and lifestyle profoundly influence how individuals think and act (Delgado-Gaitan & Trueba, 1991). Goodenough (1976) says that "the culture of any society is made up of the [group's] concepts, beliefs, and principles of action and organization" (p. 5). Anthropologists agree that, from a pedagogical standpoint, a study of other cultures serves as a beacon for an understanding of an individual's own culture. People's habits, routines, and viewpoints seem natural and right to them. Only by examining variations in social institutions, different communities, religions, homes, schools, and the particular links among them do we come to see our lives in perspective and to understand our ways as single alternatives among many (Kephart, 1987). Hence, if one of our objectives is an enlightened science and science instruction in our schools, then studying various microcultures and how science is taught in these microcultures may provide fresh perspectives on how we conventionally teach science.

Linton (1945) describes the content of any homogeneous society as being divided into three categories. First, a concept of commonality of ideas, habits, and conditioned emotional responses exists among adult members of the society. To this category belong language, the social group pattern of costume and housing, and the concept of social relationships. This category also includes beliefs and traits that mostly lie below the level of consciousness such as values. These are an integral

part of the culture. For the Oak Knoll Amish Mennonites, beliefs in shunning and in Christianity would fall into this category.

Second, some elements of culture are shared by members of certain socially recognized groups of individuals but not by the total population. For example, all women within the social group may be familiar with certain occupations and activities, while the men may be familiar with a separate set. In general, the men have a vague understanding of the things that fall under the providence of the women and vice versa. Under this category, activities can be assigned to special craftspeople or functionaries such as carpenters, doctors, or preachers. Any departure from this custom produces an emotional reaction within the social group. The Oak Knoll members' gendered customs of dress and their apprenticeship teaching are examples of this second element of culture.

Third, some aspects of culture are shared by certain individuals, but are common neither to all members of a society nor to its subsets. These particular aspects consist of cultural elements chosen by individuals according to their interests and other circumstances. Examples of this third category of culture include the use of horses, bicycles, railroad, automobiles, and airplanes for transportation; the variety of teaching techniques; the variety of beliefs and attitudes toward the supernatural. The Oak Knoll member's choices of using airplanes and styles of using individualized instruction are examples in this third category.

For the culture of a particular society to continue, certain functions must be met. These include reproducing, recruiting new members, distributing goods and services, and allocating power. One of the most important functions is transmission. Transmission, in this sense, refers to the passing on to each succeeding generation the rules, customs, and appropriate behaviors for operating in society. This process takes place through the principal socializing institutions or transmitters of the culture such as families, churches, and schools. By participating in these institutions,

individuals accept their roles within the social structure of society. Transmission patterns vary across societies.

For me, the notion of culture evokes a plethora of feelings, thoughts, and ideas about issues like that of lifestyles, worldviews, sense of place, experiences, and language. When I think of lifestyles, I include the way of living that reflects the attitudes and values of an individual. I believe worldviews consist of ideas about politics, religion, and social relationships. Sense of place perpetuates feelings of the mental and physical home. Experiences constitute such phenomena as a person's background with travel, sexual encounters, drugs, and interactions with people. I see language as a strong tie to hold a culture together. Within the official language are colloquialisms. These colloquialisms help keep the boundaries of the culture in tact.

Dreeben (1968), Durkheim (1969), Merton (1967), and Parsons (1959) view the educational system as one of the structures that carries out the function of transmission of attitudes, values, skills, and norms from one generation to another. According to these structural functionalists, educational systems perpetuate the accepted culture. The idea of accepted culture suggests a consensus on which values, attitudes, and behaviors are transmitted. When a conflict over values arise, adjustments are made to regain consensus and keep the system balanced. For example, in the mid-twentieth century United States, conflict arose over whether school curricula should portray the United States as a white-dominated society in which immigrants were expected to assimilate or a multicultural society in which differences were celebrated (Spring, 1996). The past few decades have witnessed a plethora of adaptations in curricula to address these differences in United States society.

Because of the adaptation of curricula to the changing dynamics of United States society and the important role that schools play in the transmission of culture, every opportunity to investigate this phenomenon needs to be explored. Schooling is

a very powerful social agency for this cultural transmission. It is not a separate entity but is part of the intricacy that makes up United States society.

Even subjects such as science and technology become a reflection of the cultural transmission of a particular set of values. (Hurd, 1994). Science and technology reflect the different cultures in the United States. Considerable research has been done on science and technology in United States public schools. However, to develop a more holistic understanding of all social institutions and their relationships to science and technology, more research is needed on people's everyday practice of science, on science instruction in alternative settings, and on science in home-school relations.

Therefore, information on how science is understood and how science is taught within the varieties of United States microcultures can represent alternative views of knowledge, skill, and value. The teaching of values in the science classroom of public schools and universities should be recognized and affirmed. Just as important is the critical examination of technology. One microculture unique in its approach to implementing technology is that of the Oak Knoll Amish Mennonites.

By understanding the Oak Knoll Amish Mennonites' responses to the universal pressures of modernity and their adaptations of certain technologies, science educators may be in a better position to understand not only this group but also the limitations and potentials of modernity in their own communities (Kraybill & Olahan, 1994). Examining a community unique in its approach to implementing technology allows an understanding and appreciation of science, science education, technology, and their relationships to United States culture.

Origin of Study

My educational journey has two distinctive paths: my love for science and my interest in different cultures. My love for science was developed early in life. I

was an only child who lived on a farm. My first friends were animals, and my first playground was the woods. Those pleasant memories were the foundation for my passion for science and the beginnings of my pursuit of teaching science. For many years, my cats served as my audience. My classroom was an antiquated building that contained a slate chalkboard bought by my grandfather for a few dollars.

My interest in different cultures began as a six year old when I met a missionary from the Belgian Congo in Africa. Sara Shafe's calling as a missionary was not my interest or focus. This woman spoke to our congregation and was one of many visiting religious educators from other cultures. She talked of the richness of the lives of people whose material possessions were very few. She told stories of her journeys in the Congo. I remember the intensity with which I sat and listened as she told of the people in a far away land.

A second incident contributed to this interest in studying multicultural education. When I was in the second grade, two new students came to Sharon Elementary School. Their names were James and Frances, and they were African American children. This was the first time African American children had come into my school as students. My first memory of them in the classroom was the teacher physically separating James and Frances from the white students, putting their desks on the wooden platform near the chalkboard, the one used so small children could reach the board to write. I will *always* wonder about the purpose of locating Frances and James there. Was it to separate them from other students in the class? Was it because the teacher was worried that no one would speak to them? What was her motive? I was excited about them being there, and I went home to tell my mother about James and Frances. She told me she knew them and that they were named for my grandparents.

A third incident involved the Oak Knoll Amish Mennonites coming to Sharon School. Loretta and Ray moved from Virginia to South Carolina with

several families. I was in awe of Loretta's prayer hat and long dresses. Although some individuals looked down on such differences, I reveled in knowing people who held different beliefs or who were not from my same background.

A later incident involved my friend Harby. When she came to the middle school that I was attending, we became instant friends. One of the things that I thought was unique about Harby was that she was Jewish. I found that fascinating and relished the times her mother would tell me about the significance of the menorah and the Star of David.

In all these instances, education not only played a special role in determining my response to cultural occurrences but also gave me tools to establish a place where multiculturalism can be transmitted in the educational system, specifically in the science classroom. This multicultural journey began early in my life but has permeated every facet of my teaching and my research agenda. This interest has led me to reflect on culture and its relationship to science teaching and science research.

Until recently, science educators have taken a single, monolithic approach to science instruction. They have assumed that the same science should be taught similarly to students whose variations are incidental to the subject matter. Some science educators have without questioning considered the science that they select, the instruction they advocate, and their knowledge of students they know to be right and natural and normal. However, just as the United States has always been a pluralistic society so too are we learning that United States schools, the communities they serve, and the subjects they teach are pluralistic. How science is conceptualized and how it is taught varies across communities and microcultures in United States society. In the past some science educators have condemned these variations as incorrect, inaccurate, misguided. What the multiculturalist brings to an examination of science instruction is questioning of the variations (M. Atwater, personal communication, March 15, 1995). What sciences are taught in different

places? How are these sciences taught? What school-community relationships are presupposed in this science instruction? How does this science instruction compare to mainstream school science?

In this dissertation, I present information about a small religious community and its definitions of and teaching techniques about science and technology. I explore how these definitions of and teaching techniques for science are necessary to maintain and make viable this Oak Knoll Amish Mennonite community. Examining this community contributes to the dialogue on alternative definitions of science and technology. Finally, a critical examination of technology and its relation to science, to local communities, and to a global community is discussed.

Disciplinary Frameworks

To examine science instruction among the Oak Knoll Amish Mennonites, I have grounded my research in two disciplines: science education and anthropology. Stepping back and incorporating a second discipline, anthropology, allows me to take a more critical view of my central discipline: science education. From anthropology, I adapt these ideas: control and transfer of knowledge in a culture, religion as a social agency, utopian societies, the folklore of science, a critical view of technology and material culture, school and community linkages, and my mode of inquiry—ethnography. From science education I apply a definition of science, a definition of technology, and a view of the interaction of science and technology. I also present a linking thread of the teaching and learning presented by the science educator and scholar that run through all of science education. Because I have been studying interactions, I have used ethnographic research to study all the social agencies that have a cultural significance in the selection and use of technology.

Ethnographies are analytical descriptions or reconstructions of whole cultural scenes and groups (Spradley & McCurdy, 1972). Ethnographies recreate shared

beliefs, practices, artifacts, folk knowledge, and behaviors of cultures (LeCompte & Preissle, 1993).

In the anthropological tradition of the last 125 years, ethnographic research has been holistic, global, and systematic. Ethnography provides the reader with an adequate contextualization of the cultural phenomena under study (Delgado-Gaitan & Trueba, 1991). Anthropologists such as Arensberg and Kimball (1940), Ogbu (1974), Warren (1967), and Wolcott (1967) have studied the interaction of individuals in a community and such institutions as school, home, and church. These ethnographers use cultural description and interpretation as their basis for ethnographic writings. Other anthropologists such as Chang (1991), Spindler (1982), Hostetler and Huntington (1981), and Wolcott (1973) have written ethnographies representing many cultures and microcultures. For example, Hostetler and Huntington's (1981) ethnographic study of an Amish community in Ohio found that families and individuals are supported by the community throughout their lives.

Another example of an ethnography that parallels my study of the Oak Knoll Amish Mennonite community is Wolcott's *A Kwakiutl Village and School* (1967), which investigates a Canadian Indian community. The study has two parts. Part one deals with village life and the social environment in which village children learn to become village adults. Wolcott comments that his study is a reflection of what village adults and children do and how they talk and feel about what they do. Part two deals with the educational system operating within the village (Wolcott, 1967). Wolcott invites his readers to ponder the problems uncovered by this ethnographic study. He intended the study to begin a professional dialogue on education as a cultural process. He believes that individuals adapt to the reality of the social environment in which they exist. Wolcott adds that individuals cannot be held responsible for single-handedly altering those circumstances (1967). These communal interplays are essential for understanding communities' worldviews.

Drawing from the disciplines of anthropology and science education, I construct in this dissertation a representation of the Oak Knoll Amish Mennonite community's worldview of science and technology. Just as important, I describe the interplay of science and technology in this community.

Research Questions

My research questions have determined the research method I am using. This ethnographic study has been ongoing since 1993. The questions have evolved along with my continuing growth and understanding of the Oak Knoll Amish Mennonite community of which I am a participant observer. These questions have guided the study:

1. What is science to these Oak Knoll Amish Mennonites?
2. What is technology to these Oak Knoll Amish Mennonites?
3. What is taught in the community schools as science? How? What is the rationale for these approaches?
4. What technologies are found in the Oak Knoll Amish Mennonite School? What is their purpose? How do students learn about these technologies?
5. What are the uses to which technology is put by these Oak Knoll Amish Mennonites in the community? How? What is their reasoning for these uses?
6. How does this Oak Knoll Amish Mennonite school's treatment of and experience with science and technology compare to what has occurred over time in public schools in the U.S?

Research Design

Human culture is based on the ability to organize the world into meaningful patterns. This organization by humans extends beyond society into the world at large (Jolly & Plog, 1990). Peacock (1987) suggests that "Human life should be

viewed as a whole, a configuration interwoven of many forces and aspects, all organized by culture" (p. 1). An ethnographic framework can generate an understanding of the interactions of the social agencies in this Oak Knoll Amish Mennonite microcultural community.

One of the main tenets of anthropological theory is understanding the total culture of a group. The concern is not only with the exotic or specific customs, but also with the complex whole as it constitutes a way of life. To achieve this holistic understanding, the anthropologist enters the natural setting to observe the life of the group. The anthropologist must engage in conversations with group members, listen to them talk, work and play with them, participate in their activities, and describe their cultural knowledge. The result is an ethnography. Ethnographic detail is central to cultural anthropology. This allows comparison with other groups to explain similarities and differences across societies (Stout, 1956).

In examining any small religious community, entrée into the community is a primary concern. Emerson (1983) says, "The process of gaining entree, which involves a continuing, progressive series of negotiations rather than a one-shot agreement, puts the fieldworker in the presence of the on-going social life to be observed" (p. 176). To gain entree into a small religious community, a participant observation strategy is needed. Participant observation (Kluckhohn, 1948) directs the researcher to become involved in the activities of the community. From initial participant observations, the researcher develops a path for getting information necessary for understanding the community--including school, church, home, and businesses. The researcher's interpretation of ethnographic interviews allows the investigator to go beyond the information offered by the informants and find deeper understandings. Journals and fieldnotes allow the researcher to reflect on what has happened and to find and to explore behavioral patterns. Audio- and videotaping provide the researcher with a record for examining these events and studying the

communication patterns and the linguistic exchanges observed. The ethnographer also looks through all data for patterns of change (Delgado-Gaitan & Trueba, 1991).

According to LeCompte and Preissle (1993), ethnography is associated with a group of theoretical perspectives from sociology and anthropology. These include structural functionalism, symbolic interactionalism, social exchange theory, and conflict theory. Ethnographers such as Mead (1928) also combined ethnographic methods with individually oriented theoretical perspectives from fields like psychology. Recently, researchers have included critical, feminist, and poststructural approaches with the traditional theories. Each of the preceding theories addresses the interaction of humans and affects how an ethnography is constructed. Ethnography not only is used to investigate these processes but also to represent a theoretical perspective. How the researcher uses this model varies according to the data, the context, and the theoretical framework necessary. LeCompte and Preissle (1993) suggest that ethnography has been used for studies on cultural transmission, socialization, acculturation and change, and culture and personality. Ethnography not only stresses the discovery of shared beliefs, practices, artifacts, folk knowledge, and behaviors but also highlights the social mechanisms that facilitate these processes. When these constructs are combined with concepts like social roles, they provide a structural framework for exploring the social construction of meaning.

Educational ethnographers have been concerned with developing and applying theories of educational change, schooling, race relations, and instructional organization. LeCompte and Preissle (1993) maintain that the ethnographic design is well suited for this type of endeavor. They say the collection of empirical data that generate complete descriptions of events, interactions, and activities leads logically into the development or applications of categories and relationships. Through this process of interpretation readers may grasp how products of ethnographic design are

tied directly to theory. These categories and relationships are incomprehensible without the integrating and interpretative functions of the theory that informs them.

My intent has been to categorize the data collected from the Oak Knoll Amish Mennonite community to provide a greater understanding of this microculture's definition of science and technology for the discipline of science education. This information is used to address my research questions from an ethnographic perspective, written in an ethnographic form. The ethnography is based on concepts and ideas central to a holistic understanding of the cultures and social systems discussed in the following chapter.

CHAPTER II

CONCEPTUAL FRAMEWORK

In this chapter I discuss the concepts that frame this research. Each of the following ideas contribute to part of a conceptual understanding of the Oak Knoll Amish Mennonite Community. This particular conceptual framework provides the reader with the lens though which I focused my research. Ideas included in this conceptual framework are cultural materialism, community in the United States, community and school, technology and society, religion and community as social agencies, science and the scientific community, the relation of science and technology, pluralism in science and technology, folklore and science, and indigenous science and religion. However, first a background on the Amish Mennonites--Mennonite history, Gelassenheit, the Oak Knoll Amish Mennonite community, and Amish Mennonite schools--is presented.

Amish Mennonite History

The name Mennonite derives from a sixteenth-century Anabaptist church reformer named Menno Simons. He was troubled by the Roman Catholic belief that Jesus Christ is physically present in the flesh during mass (Dyck, 1967). Another theological doctrine he found objectionable was infant baptism. His teachings against these two ideas established him as an evangelical preacher in the Mennonite faith.

Another of his opinions that came to be a core belief of the Mennonites is that, contrary to Lutherans and Calvinists, a society that does not have a common religion is dangerous. His idea was that believing in a common religion holds

communities together. This idea fuels the strong community spirit characteristic of groups such as Oak Knoll.

The Mennonite religion originated in Switzerland and Germany. The group whom the Amish Mennonites, at this time called Anabaptists, count as forebears were pacifists. They believed that a person could become a Christian only by a personal and voluntary decision, and they called for the church to separate from the worldly order of politics, civil society, and state. Because of religious persecution, which included burning at the stake, strangling, and beheadings, the Amish Mennonites in Europe frequently moved and resettled throughout the continent. Eventually, some communities came to North America. The first permanent settlement of Mennonites in North America was made at Germantown, near Philadelphia. Twenty years after the first American Mennonite preacher was chosen at Germantown, a new Mennonite settlement was started in Lancaster, Pennsylvania (Schlabach, 1988).

The Oak Knoll Amish Mennonite community members consider themselves Mennonites. The Amish designation signifies a more conservative branch of the Mennonite religion. Jacob Ammann, a preacher in the Mennonite church, became disturbed over several issues in the Mennonite church, so the Amish religion was established from a split in the Mennonite faith. One major difference arose between those who became the Amish and the remaining Mennonites. This dispute centered on degrees of discipline by use of shunning and on separation from the secular world by wearing certain clothing. Some individuals wanted stricter rules on attire and more rigorous use of shunning. These individuals who wanted the stricter rules became known as the Amish.

Gelassenheit

The Amish Mennonites have used the German word *Gelassenheit* to signify the yielding of the individual to higher authorities such as God and the Christian

community. *Gelassenheit* is the foundation of the values of the Amish Mennonite culture and includes self-surrender, self-denial, contentment, and a quiet spirit. Individualism is suppressed as a threat to the larger Amish community (Kraybill & Olshan, 1994).

Groups such as the Amish Mennonites engage in several defensive techniques for cultural survival that promote the idea of *Gelassenheit* (Kraybill & Olshan, 1994). They are: 1) *Symbolization of core values*--Cardinal values are symbolized by objects and rituals that call for group loyalty and accent group identity; 2) *Centralized leadership*—Threatened groups often use authoritarian leadership because it speeds decision making and offers a sense of security. Democracy is seen as crippling a group's ability to respond quickly to external threats; 3) *Social sanctions*—A system of rewards and punishments is necessary to encourage conformity to group standards. Leaders in the community establish the standards and administer the sanctions formally and informally to keep the community members' actions in line with group norms; 4) *Comprehensive socialization*—Like other defensive groups, the Amish Mennonites must find ways to pass on their worldview to their offspring as well as to newcomers. Indoctrination into the group's ideology through formal and informal schooling must start early in life and be repeated over and over again to build group loyalty; and 5) *Controlled interaction with outsiders*--Participants believe that the fewer the opportunities to mingle with outsiders, the less likely that members will leave the community. When interaction with the secular world is necessary for economic survival, the time, place, and mode of interaction is carefully monitored. A special lexicon, taboos on public behavior, and social isolation are common ways the Amish Mennonites limit social interaction. These cultural fences make it difficult for group members to join secular societies (Kraybill, 1989).

To resist being consumed by cultural adversity, religious communities develop programs of social control. Techniques of social control suppress individuality and serve as cultural barriers against the secular world. On issues such as controlled interaction with outsiders, a balance must be created. In the church, school, and home environment, the interaction with outsiders is more limited. However, in the businesses, the community members interact with many secular members of society. The business owners know this social exchange must occur for their work to prosper. Symbolization of core values, social sanctions, and comprehensive socialization for the Oak Knoll Amish Mennonite community closely adhere to the techniques prescribed by the idea of *Gelassenheit*.

Amish Mennonite Schools

In resisting modernity, the Amish Mennonites have learned to negotiate with it. They have changed, indeed modernized, in many ways over the twentieth century. Yet on some issues, such as education, negotiation is resisted (Kraybill, 1989).

For the Amish Mennonites, the purpose of school is to ready the child for the Amish Mennonite way of living and the responsibilities of adulthood in an effort to establish the core foundations of a society of useful, God-fearing, and law-abiding citizens. For the Amish Mennonites, the school is a microcosm of the church community (Kraybill & Olshan, 1994).

In contrast, the United States public schools serve multiple purposes: intellectual, political, economic, and social. The three primary intellectual purposes of schooling are acquisition of cognitive skills, substantive knowledge, and inquiry skills (deMarrais & LeCompte, 1995). Public schools are seen as places that must produce future citizens and workers. Therefore, the political purposes of mainstream schools are to educate future citizens for appropriate participation in the given political order; to promote patriotism by teaching myths, history, and stories about the country, its leaders, and government; to promote the assimilation of immigrants;

and to ensure order, public civility, and conformity to laws. Schooling serves two economic purposes: to prepare students for later work roles and to select and train the labor force. Last, schools contribute to three social goals: to promote a sense of social and moral responsibility, to serve as sites for the solution or amelioration of social problems, and to supplement the efforts of other institutions of socialization, such as the family and the church (deMarrais & LeCompte, 1995). These purposes of mainstream schooling contrast with those of a small religious community such as the Amish Mennonites.

Table 1 represents a comparison between Amish Mennonite schools and mainstream public schools (Kraybill & Olshan, 1994) and illustrates many differences and few similarities. The central distinctions include fostering a communal lifestyle tradition rather than promotion of individual expression and progress. Amish Mennonites stress acceptance without question, and mainstream schools emphasize individuals' searching for truth. One similarity is the use of critical thinking. For mainstream schools, critical thinking is encouraged in science (AAAS, 1996); what is lacking is critical thought about the technology used to study science. Public schools encourage critical thought about the scientific ideas, but refuse to contemplate the technological lenses used to pursue the ideas. Of course, science and technology could be taught as complementary, and students could learn to consider both initially.

Oak Knoll Amish Mennonite History

By the early 1960s, some of the Amish Mennonites of Virginia Beach, Virginia, had become dissatisfied with their living conditions (Document, May 5, 1995). The rural area where they resided was gradually being transformed by development into a more urban environment. This development contributed to the inflation of land values and to tax increases. However, a greater concern was the effect urban life and the values associated with it could have on children.

Table 1

Comparison of Amish Mennonite Schools and United States Public Schools

Amish Mennonite Schools	Public Schools
• are run on a human scale • are operated by parents without an administrative bureaucracy • stress drill accuracy and proper sequence • train students to stay in their community • stress tradition • pick teachers because of their Christian example • have teachers who are generalists • value cooperation and humility	• are run on an organizational scale • are operated by professionals with an administration • stress speed, variety, and freedom of choice • train student to get ahead in life • stress progress
• reject technology • rank penmanship high as a skill • favor group identity • have no kindergarten • use a limited amount of lesson material • see child as a Mennonite	• pick teachers because of their ability and training • have teachers who are specialists • value competition and pride in achievement • embrace technology • rank pehmanship low as a skill • favor individual expression • have kindergarten • use a great amount of lesson material • see child as an individual with intellect
• hire only Mennonite teachers • stress memorization • see learning as work • believe truth is revealed in the Bible • stress believing	• hire teachers with an intellect • downplay memorization • see learning often as fun • search for truth • stress questioning

Because of their agrarian lifestyle, these Amish Mennonites saw little hope for their future in Virginia Beach. Many of them expressed interest in relocating to another community, where they could continue perpetuating their values and beliefs. Over the next several years a small group of three to four elders traveled to survey prospective land purchases in the southeastern part of the United States.

Several farms were found available in [name of state]. Three families took options on buying a farm. The first purchase among the first five families included approximately 1000 acres of farm land. The Amish Mennonites began to migrate family by family to [name of state] on June 10, 1969. Today, approximately fifty families live in the Oak Knoll community. One of the original family members shares thoughts about the move (Document, November 17, 1996):

> Most of the adjustments were pleasant ones. Having lived in such a congested area, it was no longer the normal practice to wave at people as you pass on the road. Here again were folks who were interested enough to wave as you pass by. (p. 11)

The Amish Mennonite children attended public school the first year they were in [name of state]. Their own school was opened in September, 1970. Stoll says (Document, November 17, 1996), "This [opening of the Amish Mennonite school] was done in full cooperation and respect of the public school system" (p. 11). Stoll believes that the greater community acknowledged that the Amish Mennonites wanted their own school. He also suggests that the school board of this community respected the Amish Mennonites for their decision.

Community in the United States

Fagnano and Werber (1994) write of rural, farm communities in the United States in the early 1900s:

> Back then, the community not only supplied much of the mortar holding families together and joining them with neighbors, it linked people with their work and what they did with their free time. (p. 6)

It was the community that held together the social institutions. Parents, teachers, principals, religious leaders, and the family doctor were in touch with each other. Children knew this, and many thrived on it. Fagnano and Werber (1994) further comment,

> Today's communities lack the magnetic force once supplied by the stable family, by other care-giving institutions, particularly religious, and by the values they generated. (p. 7)

What is left in all too many communities is the environment defined by the forces that it lacks, those of trust, respect and security. Martin (1992) writes of the institutions of home and school in the American community, "It is a fact too seldom remembered that school and home are partners in the education of a nation's young" (p. 6).

To keep communities intact, people have searched for alternative lifestyles throughout history. Idealistic groups have instituted the utopian society. This is founded on the proposition that a human is a rational, willful, conscious, and intentional individual. Members are optimistic about the nature of humans, stressing their potential for goodness. attainable if the individual is placed in the proper society (Hostetler, 1974). Utopias have no place for revolutions, riots, strikes, or poverty. Utopia is "the imaginary society...where all physical, social, and spiritual forces work together, in harmony, to permit the attainment of everything people find necessary and desirable" (Hostetler, 1974, p.2). Utopians believe that the satisfaction of human wants is attainable only through the eradication of what the group considers evil. This is one reason Amish Mennonites qualify as a utopian community. Social systems draw their ideals not only from the realm of what is, but

also from the realm of what might be. Individuals use these ideals to inspire collective involvement. helping all members to conform to the goals.

This community tradition includes individuals and groups who have attempted to live communally, sharing material goods and a common lifestyle. Utopian societies grew rapidly in the United States during the nineteenth century (Hostetler, 1974). These communities included Shaker, Oneida, and Amana groups. Based on the faith that humans can remake their institutions by choice, these utopian groups share the idea of using the small community as a creative force to reform society. Members of these utopian societies believe that individuals are free to choose their own destinies.

American utopian societies divide into the sacred and the secular. In many instances, the religious utopian societies are based on the Biblical *Book of Acts* that provides them with a model in the communalism of the apostolic church. These groups perceive themselves as reinstituting the ideal Christian community (Holloway, 1951). Holloway (1951) suggests that "there must be some fundamental belief to which all members subscribe--a belief capable of sustaining them in all crises and uniting them in spite of all minor dissensions."

Amish Mennonites are rooted historically in the context of sixteenth-century European Christianity, with its utopian ideals and practices. Religious utopias have ideal dimensions: (1) communalism of production and consumption; (2) personal and social equality; (3) peace and harmony in all human relations; and (4) the meaning and allocation of work subordinated to the benefit and purpose of the collective (Redekop, Ainlay, & Siemens, 1995).

Most utopian societies represent some rejection of the dominant culture. Roszak (1969) describes utopian originators who come to believe that many of the things that they had been taught as true are false. Nonconformism may be a reaction against the dominant society. Some groups may be extremely active politically,

though most appear to be passive, condemning the dominant order. Their communal sharing involves material goods, lodgings, income, family responsibilities, ideology, and social organization. The purpose is to return to perfect harmony with nature, rather than to exploit nature. For example, some groups are preoccupied with organic gardening and agrarian self-sufficiency in rustic settings (Roszak, 1969). Modern technology is viewed as oppressive and dehumanizing. Therefore, because the Oak Knoll Amish Mennonite community rejects many secular values of the dominate culture, communally share ideology and social organization, and live, as close as possible, to an agrarian self-sufficient life style, they are considered a utopian society (Hostetler, 1974). With profound implications for all science educators, the understanding of utopian societies offers perspective, breadth, and variation in viewing ourselves as one group among many. By looking holistically at other groups, we may be able to gain new knowledge about our own culture, thus gaining a more critical insight into the discipline of science education by using anthropological theory.

Cultural Materialism and Technology and Society

To reiterate, culture as defined in Chapter I is a set of shared ideas, beliefs, values, and standards of behavior. Culture is the common element that makes the actions of individuals intelligible to the group. One way to organize elements of culture is into three categories: ideology, social organization, and the material base (Bidney, 1967). Ideology encompasses language, goals, emotions, belief systems, values, ethics, worldviews, and religions. Social organization includes family systems, socialization, and education; roles, statuses, and identities; government (laws, power, and decision making); life cycles; and patterns of time. The material base embodies technology (skills, techniques, and artifacts), communication, medicine, production and distribution of goods and services, and uses of natural environments. Materialism is an integral part of culture (Bidney, 1967).

Like most twentieth-century societies the Oak Knoll Amish Mennonite community depends on its material base, and the idea of materialism predominately separates the technologies found in the institutions of church, home, school, and businesses. The theory of cultural materialism is concerned with understanding material products and their relationships to the social, political, and spiritual processes of life (Marx, 1973). Cultural materialists seek to explain the balance maintained between sociocultural practices and the ecological, chemical, and physical parts of nature.

Cultural materialism holds that social changes are initiated and accelerated by production and reproduction throughout the domestic, political, and ideological groups rather than vice versa. In other words, supply and demand of material goods affect all the institutions. Supply and demand are directly influenced by technological innovations. In the case of the Amish Mennonites, new technologies adopted by their business competitors affect what new technologies are added to their own businesses. They must stay aware of the new technological advances for economic viability (Harris, 1979).

Craumer (1995) claims that the Amish Mennonites, more than any society studied, illustrate the effects of cultural values in determining the use of technology and natural resources. These cultural values include several elements. (a) Rural living backed by a solid agricultural economy has been considered the norm by some Amish Mennonites. (b) Communal living helps separate and protect the Amish Mennonite from the outside world. (c) Religious beliefs have caused them to turn their backs on a number of energy-using techniques while still benefiting from modern scientific knowledge. Even historically, Amish Mennonites struggled to keep a strong material base. The Dutch-Polish Mennonites who migrated to southern Russia during the eighteenth century transformed the arid lands they found and successfully introduced fruit, shade, and mulberry trees. Amish Mennonite

agricultural experts developed new breeds of cattle and horses. Specifically, the Soviet or Red Cow is derived from a breed of dairy cow developed earlier by the Amish Mennonites (Hostelter, 1983). Similarly in southern Russia, Amish Mennonite agriculturists produced a special type of grain called Turkey Hard Winter Wheat (Hostetler, 1983). Flour made from it was not only more nutritious, but the wheat yielded better with less rainfall, and it had greater resistance to plant disease than did other known varieties (Hostetler, 1983). The Amish Mennonites have excelled as farmers in many countries where they have settled. In the Elemental Valley and Jura Mountains of Switzerland they developed new varieties of clover crops. They also produced fine cheeses and wove high quality linens (Hostetler, 1983).

The Oak Knoll Amish Mennonites considered the purchase of small farms to support their community and institutions to be imperative. They also sought an available local market where their agricultural products could be sold.

Cultural materialism and its relationship to the social, political, and spiritual components of life is essential to the understanding of the Amish Mennonites. This relationship is the key to the adaptation and viability of the community. A comparison found that English farmers use eighty-three percent more energy to produce a unit of milk than did Amish farmers (Craumer, 1995). The Amish Mennonite ethic of conservation and its economic consequences also account for the prosperity and expansion of Amish Mennonite agriculture. Their simple technology, resulting from their conservation ethic, is the hallmark of the Amish Mennonites. The relationship between their religions values and beliefs and their conservation ethics has enabled them to avoid the major causes of small farm poverty and bankruptcy: the difficulty of acquiring money to buy modern machinery or payments (Craumer, 1995).

For example, many individuals in modern society embrace social change, viewing each new technology as a sign of progress. In contrast, the Amish Mennonites are skeptical about advancements in science and technology, even though they partake of some of these technologies in their community. On many occasions, the Amish Mennonite community meets technological innovation with resistance. Kraybill and Olshan (1994) write of the Amish Mennonites,

> Their battle with modernity has been a struggle to save their cultural souls.... But the Amish are engaged in a war against the spirit of progress, against arrogance, against progress as a goal, and against the social fragmentation and alienation that often accompany some forms of progress. (p. vii)

Technology is the construction of tools, in the modern world, using applications of scientific knowledge (Haviland, 1996). The technological tools of science are used to collect and construct patterns of data, allowing science to create linkages in communication between empirical and theoretical information, resulting in changes of knowledge (N. Thomson, personal communication, September 20, 1996). For individuals in a modern technological society to understand critical technological issues and the nature of the technological heritage, they must have access to relevant information. Through advancing technology, individuals can be freed from rote memory, allowing time to learn how to think, logically and creatively (McIrvine, 1967). McIrvine (1967) also says of culture,

> Every viable social system must ensure that the vast majority of its members accept its assumptions about the nature of reality, about events, and about right and wrong. This result is achieved through the process of education by inculcating values in each child. Thus, each culture and institution tend to perpetuate itself. (p. 9)

McIrvine (1967) suggests that education is one of the central institutions that instills communal values into the child. It is through this instillation of values that

communities perpetuate themselves. Mackenzie and Wajcman (1985) suggest of the relationship between culture and technology,

> In its strongest form, the theory [of technological determinism] claims that change in technology is the most important cause of change in society.... Answering the question of the effects on society of a particular technology requires one to have a good theory of how that society works. (p. 6)

Milbrath (1989) contends that technology is usually developed with a purpose. Therefore, if technology is developed with a purpose in mind, then technology has to be filled with a plethora of values. The new technologies people encourage and support economically are based on the values people hold.

Community, Home, and School

Whenever individuals live in a contiguous area and experience social interaction as they engage in the main pursuit of life, then a community exists. The community is the basic unit of social living. Stout (1956) explains,

> Wherever there is a school or a church or a trading center we have the nucleus of community interest. And around any one or all of these agencies, together with other centers of living usually found in the more highly organized areas, there has developed a pattern of life that touches in one way or another every citizen in America. (p. 3)

Patterns of diverse communities are found everywhere in the United States. All of these together make up United States society. Stout suggests social agencies, such as the school or households in the community, comprise the strength through which individuals receive their basic needs.

The community is a complexity of human interactions clustered around many concerns creating a positive environment for individuals to live (Haviland, 1996). Economics, education, health, and spiritual growth are some of the major social functions that constitute the nucleus of social living (Haviland, 1996). These major

social functions are woven into an intricate web of social interactions that compose the essentials of community.

The nucleus of this community is found in the home. The individual's world begins with the family and expands to include other groups such as schools, churches, and volunteer groups (Haviland, 1996). In the United States, secular education ensures that the individual is exposed to an expansion of social living by the interaction of many of the social agencies as previously listed. The first social agency that the child is exposed to is the home (Redekop, Ainlay, & Siemens, 1995).

In the home, the child receives the first lesson in socialization--that of responsibilities to others. Religion also contributes to the socialization of humans, often affecting spiritual and moral development. Moral development allows individuals to take their places in society with dignity and respect. Finally, the school is one of the major socialization agencies of the community. One purpose of schooling is developing the individual for complete living (Stout, 1956). Stout also says of other socializing agencies [referring to public schools],

> The quality and quantity of the contacts [with other social agencies] are of major concern to those who would make the community more effective in assisting the development of desirable personality....Thus community organization promotes and conserves human values. (p. 9)

All of these social agencies--home, school, business, and church--work simultaneously to build a community to help in an effort to develop the child. Importantly, school has a key part in this process. One connection that ties the Oak Knoll Amish Mennonite community together is the strong relationship among the community, home, and school. Even though the secular and Oak Knoll Amish Mennonite communities are very different, both promote and conserve human values--but different sets of human values.

Religion and the Community as a Social Agency

Technology has been embraced by much of the world. However, for the Amish Mennonites, it has been a source of struggle. They lack others' confidence that reason and technology will eventually eradicate war, hunger, poverty, and other human plagues. Strongly linked with reason and technology is the discipline of science. During the Age of Enlightenment many intellectuals assumed that scientific explanations would replace religious explanations. However, this position ignored other functions of the religious experience and the unanticipated and undesirable consequences of both science and technology (Eamon, 1994; Hollinger, 1994).

The persistence of religion in the face of Western rationalism indicates that it is a powerful and dynamic force in society. Social and cultural anthropologists have shown how each religion embodies a number of "truths" about humans and society (Haviland, 1996).

Individuals create and maintain cultures to deal with the problems that concern them (Haviland, 1996). For the Amish Mennonites, the agency that holds their community together is religion. Religion is a set of rituals, which mobilizes supernatural powers for the purpose of achieving or preventing transformations of state in people and nature (Haviland, 1996). For instance, the main tenet of many Christian religions is that Jesus Christ was transformed from the physical state to a spiritual state. Another belief held by some Christian religions is that some individuals will remain in the physical state as a punishment for not believing in Jesus Christ. Religion consists of these various rituals through which individuals try to manipulate supernatural beings and powers to their advantage. Whether or not a religion accomplishes what humans think it does, it serves multiple psychological and social functions.

Religion also (a) reduces anxiety by explaining the unknown and making it understandable, (b) provides comfort in the belief that supernatural aid is available

in times of crisis, (c) provides notions of right and wrong, setting precedents for acceptable behavior, and (d) transfers the burden of decision making from individuals to supernatural powers. Religion, therefore, can be used to enhance the learning of oral tradition and to maintain social solidarity or the sense of community (Haviland, 1996). Religion addresses psychological needs such as confronting and explaining death. It can offer a path by which individuals transcend their earthly existence. The social functions of religion are *no less* important than the psychological functions. A traditional religion reinforces group norms, provides moral sanctions for individual conduct, and provides the foundation for common purpose and values on which the stability of the community depends (Haviland, 1996).

No matter the composition of a community, the values and beliefs that comprise it are the unifying factors. Such is also the case in the scientific community (Bernstein, 1983).

Science and the Scientific Community

The scientific community defines science by its content, its processes, and its participants. For some, science has been defined as an orderly body of knowledge. To other individuals, science is a search for explanations of natural objects and phenomena. For many, science is an area of investigation asking particular questions and consisting of problem solving, model building, and model revision (N. Thomson, personal communication, September 20, 1996).

Science is a way individuals make sense of the visible world and the universe. Science seeks testable explanations for observed phenomena in terms of universal laws. Two basic components of this are imagination and skepticism. Imagination is needed for thinking about phenomena in new ways. Without it, there can be no science (Haviland, 1996). Skepticism is what allows the scientific community to test the speculations. Supernatural explanations are rejected, as are all explanations and

appeals to authority unsupported by strong observational documentation. Explanations are regularly challenged by new observations and new ideas. Therefore, science is intended to be self-checking. Inadequate explanations are replaced by more reliable explanations (Haviland, 1996).

Scientists begin with hypotheses or tentative explanations of the relationship of certain phenomena. By collecting data that support the generalizations and indicate why the alternative hypotheses may be false, the researcher arrives at a validated hypothesis or theory. Even though theories may be well supported, they are not beyond challenge (Haviland, 1996).

The Relationship of Science and Technology

The distinguishing characteristic of science and technology is a difference in the ideas. The purpose of science, according to the National Science Standards (1996), is to understand the natural world, and the goal of technology is to make modifications in the world to meet human needs. Technology and science are intimately related in Western culture. Any specific solution to a problem frequently has both a scientific and a technological component. The need to address questions about the natural world drives the progress of technology. Similarly, technological needs can drive scientific research (National Research Council, 1996).

Pluralism in Science and Technology

In the U.S. science traditionally has been taught from a modern, Western perspective rather than combining perspectives from around the world. One reason for this is the public educational system's preservation of the cultural tradition of the dominant group. For example, many American Indians believe that European Americans show little respect for nature and that they are primarily concerned with the control of nature. The result of these attitudes has been massive environmental destruction (Spring, 1996). However, the study of American Indian culture can

contribute to the understanding of the relationship between nature and science. This issue of culture is central to the overall understanding of science.

Therefore, in 1992, the National Academy of Sciences developed a list of issues in preparation of the National Science Standards (1996). One of these issues is whether science instruction should reflect the tradition and culture of mainstream science. This question is politically explosive. At a 1992 meeting of the American Association for the Advancement of Science, a discussion resulted from the exclusion of Afrocentric approaches to science teaching (AAAS, 1993). Spring (1996) maintains that, given the political debate in education about ethnocentric education, the neglect of an Afrocentric approach to science in the National Science Standards is a political decision. American Indians could also have similar objections to the conventional classroom approach to science.

Though the sciences and humanities are often considered incompatible approaches to learning (Haviland, 1996), they come together in anthropology. Science may be thought of as a systematic way of understanding the world. Many anthropologists think that science is impossible because humans cannot be objective, especially about other humans.

Kuhn (1970) suggests that scientists are constrained by their particular social, cultural, and historical perspectives. This is how we understand the world. Science is an activity in which individuals monitor each other's observations and reasoning. This gives science its claim on learning truth. Science then becomes self-checking. A good example of this kind of self-checking is the convention found in ethnography.

Anthropology, with its historical commitment to understanding individuals globally, is in a good position to research the problems of humanity in the twenty-first century. As a global community, we share a global science. This promotes interdependence worldwide for a greater pluralistic scientific society

(Haviland, 1996). Therefore, a dialogue on definitions and purposes for science and technology is necessary. Finally, the goals of science and technology for all pluralistic societies should be constantly discussed.

Indigenous Sciences and Religion

For many years, folklorists, anthropologists, and other scholars have collected indigenous tales about nature around the world. For many geographic communities, just as in the science community, this is the way individuals' make sense of the visible world and the universe. Many of these cultures have a plethora of narratives that answer, in diverse ways, fundamental human questions about how we got here and who created the earth and everything on, below, and above it (Elder & Wong, 1994).

Recently, a number of anthropologists, biologists, and geologists have focused their attention on a more holistic approach to human-environment interactions and the ways individuals think about plants, animals, and the land where they live. With this new focus the field of ethnobotany was created.

Another aspect of indigenous societies shared with science is detailed knowledge of the world around us. Indigenous or native societies are concerned with a productive community that includes the social relations of its members (Maybury-Lewis, 1992). Science is also often seen in conflict with religion despite the fact that other models of the relationship between science and religion exist (Reiss, 1993). Western ideology separates science and technology from religion more than Eastern thought does.

Many people believe that religion does not have anything in common with science and technology (Watts, 1993). Religious understanding is principally concerned with spiritual experience. Science and technology involve the collecting and applying of knowledge about the natural world. The origins of the two areas of study, however, are much closer than it first appears (Watts, 1993).

To the Greeks, the search for knowledge was one subject: philosophy (*philos* – Greek for "loved"; *sophia* – Greek for "wisdom"). Philosophers branched into natural philosophers, who studied the nature of things, and moral philosophers, who studied the nature of the human soul. The moral philosophers were thought to be superior because the study of the human soul was more important than the observation of animals, forces, and stars. Gradually over time, natural philosophers became known as scientists (*scientia* – Latin for "knowledge") (Watts, 1993).

Despite the separate paths taken by the two traditions since their beginning, links still exist and can be used in a number of learning situations. These links of science and philosophy are important to the National Science Education Standards, because different content areas in the science have their own methodology and body of knowledge. Science and philosophy cannot always be applied by themselves. Philosophy is a thread that links the science content areas together (Watts, 1993).

As the popular television series the *X-Files* claims, scientific explanation is limited by the constraints of the knowledge base; as this expands, so does scientific understanding. Nothing goes against science, just what we know about it at the present time (Lovece, 1996). Some individuals use science and other individuals use religion to develop their knowledge base. Religion and science do have some common goals. Each seeks to explain the human condition, its origin, and its future. Science explains human origin through evolutionary development. Also, science is intended to further knowledge. Religion has an alternative explanation for human origins: a supernatural force. Examples of this can be found among Native American groups in North America and in Brazil. Among Native American groups three fundamental types of creation myths are widely acknowledged.

For example, the Navajo Emergence Myth tells how early forms of humans emerged from the First World through the Second, Third, and Fourth Worlds, where First Man and First Woman were created from two ears of corn. In the Mohawk

creation story, Sky Woman descends to a water-covered world. With the help of animals, she forms the earth. In this representation, Beaver, Loon, and Muskrat all sacrifice themselves to obtain land for Sky Woman. This Mohawk story also goes on to explain that humankind is created from red clay (Elder & Wong, 1994).

In the Juruna tales from Brazil, a murderous sun was replaced by a beneficent sun. The Wakaranga from Central Africa tell how the moon copulated with Morningstar and created all the trees, grasses, and plants. He copulated with Eveningstar, and from their union sprang goats, cows, sheep, antelopes, birds, then male and female humans (Elder & Wong, 1994). Beyond these cultural myths, indigenous sciences also contain a storehouse of knowledge of the natural world. Anderson (1996) says of such indigenous science,

> Most of the folk wisdom of the world's farmers, fishermen, hunters, gatherers, and craftsmen is correct, and it is exceedingly important for the modern world. Villagers in tropical forests know literally tens of thousands of useful plants that are imperfectly known--or not known at all--to "international science." Folk and non-Western medical traditions have already given discoveries that have saved millions of lives: quinine, digitalis, ephedrine, and much more. Borrowing from the folk wisdom is increasing, not decreasing.... Most of the work in studying folk science systems is chronicling their practical, valuable knowledge. (p. 101)

Anderson (1996) explains that much of the world's ancient belief systems seems like preposterous nonsense to the modern scientist. He emphasizes that likewise modern views can be ridiculous to the uninitiated. He claims that error creeps into the most rigorous science. Folk medicine, general agricultural strategies and decision making, site planning, geography, and beliefs about the powers or behaviors of plants and animals are a mixture of truth and assumption. As for these, Anderson maintains that religion becomes their carrier in indigenous societies.

Conclusion

Folklore cannot be dismissed as just tales that have been passed on. It is knowledge, superficially just a different kind of knowledge. But underneath the superficiality of folklore rests a multitude of ideas and concepts. By studying separately the concepts of community, school, and religion and then linking these together, a unique knowledge of indigenous groups may be explored. Once this knowledge is identified, a more thoughtful understanding of the indigenous groups' beliefs and values about science, technology, community, school, and religion can be discerned.

By constructing more knowledge and a deeper understanding of unique communities, science education may critically examine itself as a discipline. Therefore, science education becomes engaged in preparing science students from all walks of life. This self-examination is necessary for science education to self-check--a process that, in turn, leads to an increased understanding of the world. In the next chapter I explain how this self-checking may be accomplished through an ethnographic study.

CHAPTER III

RESEARCH DESIGN

The following is the research design used in the study. This chapter is divided into two parts. One section discusses data collection, analytic induction, ethnographic analysis, and limitations to the study. The second section presents the setting: the description of the school, teachers' views, description of the school day, the principal and key informant, the school auction, and other aspects of the school.

Research Methods

Ethnographic methodology, as already introduced, consists of a complexity of procedures through which the researcher arrives at an ethnographic statement (Emerson, 1983). In the anthropological tradition, ethnographic research is intrinsically encompassing, holistic, global, and systemic. Ethnographic research provides the reader with an adequate contextualization of the cultural phenomena being investigated. Educational anthropology over the last thirty years has developed ethnographic research concepts and tools to study schooling and learning processes from a broad cultural perspective (Delgado-Gaitan & Trueba, 1991). Ethnographic research is a method of inquiry, and the ethnographer is the research instrument (Emerson, 1983).

The goal of most ethnographers is to get as close as possible to the ongoing life and events of a group to understand and analyze it. Immersion in this intensive manner can confer a deep and accurate sense of the concerns and meanings of the individuals studied, truths often not apparent to the outsider or detached observer.

Because of this immersion necessary for intense study, I have carefully chosen a site to study.

Data Collection

Ethnographic methods are more time consuming and labor intensive than other research approaches. The study of historical records provides the ethnographer with a context for understanding the individuals and the current environment. Participant observation forces the researcher to become involved in community activities. From the historical record and initial participant observation encounters, the researcher refines a path for collecting information needed to gain an understanding of the nature of the community and school, in contrast to other schools and communities. Ethnographic interviews allow the researcher to probe more deeply for an understanding of the community. Journals and fieldnotes are constant companions that permit the researcher to reflect on what has happened. The researcher has then the opportunity to search for patterns. Audiotaping and videotaping provide the researcher with the record of events being studied. This data source allows the researcher to investigate events and to study communication patterns and linguistic exchanges. The data sources also allow the researcher to discover inferences made by those who interact in the setting. Another procedure is member validations. This is the process of taking the findings back to the members of the community studied to see if they recognize such accounts and therefore corroborate them (Emerson, 1983). Finally, the ethnographer looks at the data as a whole for patterns of change and innovation, of conflict and adaptation, and of success and failure in achievement (Delgado-Gaitan & Trueba, 1991).

Analytic Induction

I am using analytic induction as my method of analysis. Analytic induction, proposed by Znaniecki (1934), is a rigorous, systematic means for deriving theoretical propositions from empirical data. Researchers using analytic induction

begin with a rough formulation of the phenomenon to be explained and an initial hypothesis explaining the phenomena, then go to a small number of cases to see if the hypothesis fits that case.

If the cases do not fit, then the hypotheses or phenomena are reformulated. This procedure allows for the cases to be accounted for, continuing until all cases, even negative cases, can be explained. Bulmer (1969) maintains that in this way analytical induction "abstracts from a given concrete case the features that are essential, and generalizes to them" (p. 661). In reporting my findings, I use lessons learned. I choose this approach because my study involves a community outside my own. Because my value and belief system is different from theirs, it would be extremely hard for me to analyze this community critically. However, I am a member of the science community. And with this in mind, I am able to see how others teach and transmit science and technology knowledge to their children. Then, I can take those lessons to strengthen and better understand the unique cultures that make up the United States science classrooms.

Ethnographic Analysis

My research is guided by questions of how other communities teach science and technology. By learning how others teach science and technology, I can add more understanding to science education's knowledge base. By using an ethnographic study and a holistic approach to understand the community, I have been able to address my research questions as stated earlier.

Entrée is crucial. My family connections with the Oak Knoll Amish Mennonite community allowed me easy access into this community and the trust it evoked. This was for me a golden opportunity to study a unique community, one that I could not pass up. I was a participant observer in the Oak Knoll community. Only by participating in this community could I become acquainted with the value and belief system that perpetuates this society. Because of my closeness to many of the

community members, a constant balance had to be maintained in searching for the answers to my questions, but at the same time I had to respect the individuals who were sharing with me parts of their lives.

I have been in the Oak Knoll Amish Mennonite community for approximately five years, observing in the school, the classroom, the businesses, the church, and the home. Sometimes I left the community for several months at a time. This time has been used to reflect on what I have observed. I have visited the school at different times of the day to get a complete view of daily functions. I have attended weddings, auctions, church services, and yard sales. Time spent was crucial to a holistic understanding of how science and technology played out in this community.

The language these people speak is basically the same as my own English, with of smattering of German. My key informant has been there to translate idioms. For example, outsiders to the community are referred to as "English," no matter what their race, gender, or ethnicity.

I had certain assumptions about the Amish Mennonites when I first entered the community. One of my key informants suggested prior to my beginning the research that I "knock them off the pedestal, for we are human just like everyone else. We make mistakes" (Interview, May 1, 1995). I saw values that I admired in this community, and I envied a simpler lifestyle.

Most everything that I have written has been read by my key informant, Paul. Four of my six dissertation committee members have been to the Oak Knoll Amish Mennonite community, and all the committee members have given me feedback during the research process. Each committee member brings expertise in a specific area of research: Dr. Mary Atwater in multicultural education; Dr. David Jackson in technology and philosophy; Dr. Steve Oliver in the nature of science; Dr. Judith Preissle in methodology and conceptual frameworks; Dr. Norman Thomson in indigenous sciences; and Dr. Joe Wisenbaker in standards for evaluating research.

Direct quotes are used as frequently as possible to give voice to the participants. Nonverbal gestures are documented when appropriate to support the lessons learned by the community. The lessons I offer in Chapter VII are in lieu of implications. Because I entered a community different from my own, it would have been easy to criticize their way of teaching science. The value set that I came with is different, being that of the science community. Therefore, the greatest lessons I learned came from studying the community and then bringing those lessons back to the science community to better prepare our students and add some knowledge to what we know about alternative ways of teaching science.

I began keeping a journal early in the study. One of my committee members who is an educational anthropologist told me how crucial this was. The journal entries were recorded as events were occurring with one exception: out of respect for the community members, I jotted down notes on discrete pieces of paper during church services and transferred them to my journal at a later date. Data were collected through informal interviews of the students, the teachers, the principals, and community members. Supporting documents were collected when needed, usually through Paul, the key informant. No researcher-administered instruments were used.

Informal interviews were used constantly during the study. As my research questions were refined, I had to search out different individuals in the community who could provide me with information. Both validity and reliability were strengthened by my extended amount of time in the field to collect the data. Each individual gave me added information to better capture an entire picture of the community at a particular period of time. I kept asking questions until I saw answers emerge.

I distinguished between my voice and that of the participants. For emic analysis, the native informant is the ultimate judge of the researcher's descriptions and

analyses; in emic analysis, the native informant is also the ultimate judge of the accuracy of the constructs and concepts used (Hocking, 1995). The near experience, referring to the emic perspective, and the far experience, referring to the etic perspective, distinguish cultural categories. Emic and etic categories become relative conditions captured by the distinction of a near or far experience as developed by Geertz (1973). The notion of voice involves both the subject and the researcher (Hocking, 1995). It is a continual balance being negotiated between the individual and socially structured meaning. By giving more weight to the voice of the participants, we intrude less on what the community wants to share. LeCompte and Preissle (1993) believe that each of their [the participants'] voices should be considered in any discussion of qualitative research because these groups legitimize research and indicate whether qualitative results are relevant, appropriate, illuminating, and useful.

My interpretations follow the voice of the participants. Because I want the emic to be valued as much as the etic perspective, I have chosen to formulate the implications and conclusions of the study as lessons learned, as noted previously. I believe this approach balances the emic and etic perspectives: (a) lessons learned from the Oak Knoll Amish Mennonite community represent the emic perspective and (b) lessons learned for the science education community represent an etic perspective.

I also have incorporated photographs into the research as a form of illustration. Not only do these illustrate the community, but Hocking (1995) says that the power of photography helps engage thought, extend the imagination, and undermine the implicit authority of the written word. Especially when researching a small religious ministry, known for a unique style of dress and technology, the photographs produce for the reader a strong visual image.

Researchers often have to withdraw from the community to be able to see the forest for the trees. I had to pull away to examine the social phenomena created by the social agencies in the community. This backing up, extension of time, and input from all my committee members with their expertise in different areas helped me to develop a holistic view of science and technology in this small religious community.

Because of the close proximity of the Oak Knoll Amish Mennonite community to my family home, I did not have to seek external financial support for the study. This proximity allowed me flexibility to go back to the community when I had questions. It also allowed me extended time so that I did not feel rushed to collect the data and report back. It also gave me an opportunity to see the community during different times and periods of the year. And, importantly, because I did not have to account to a funding source, I was able to adjust my study to questions raised during the process. In a preliminary observation of this community, I found little science and technology evident in the formal classroom. Because of the technological products I had seen outside the school, I knew the learning must be transmitted somewhere; therefore, I further researched to see where this phenomena occurred. I then turned to the community.

Limitations of the Study

LeCompte and Preissle (1993) view the purpose of research as a search for knowledge. This perspective then poses the question, "How do researchers convince various audiences of the worth and legitimacy of their claims?" Some standards must be used in evaluating qualitative research. In daily decisions, the philosophies, theories, and methodologies of a researcher are applied, tested, adopted. adapted, or rejected. The main issue in evaluating qualitative studies is how investigators gain value in their research in their daily decisions (Lincoln, 1986). A research study can be trusted if it meets the following criteria: (1) fairness, the balanced representation of the multiple realities in a situation; (2) ontological authenticity, a fresh,

sophisticated understanding of the situation; (3) educative authenticity, a novel appreciation of these understandings; (4) catalytic authenticity, courses of action are supported by the inquiry; and (5) tactical authenticity, potential benefit of the research to all concerned.

Even though the researcher attempts to control the preceding factors in the study, to any study limitations exist. The following are the limitations common to ethnographic study:

1. The researcher's personal and social characteristics have a central relevance to the community being studied (Emerson, 1983). Johnson (1975) has emphasized the observer's gender, racial identity, socioeconomic identity, appearance, abilities, and goals as instrumental in the research process. In my research, the long-term commitment to the research project, the family connections, and the close relationship to my key informant have outweighed the disadvantages of being a female, of being "English," of being divorced, and of dressing in secular clothing. It is a constant balance that is being maintained.
2. The ethnographer attends to the issues and events in the field through a lens constructed by experience, both personal and professional (Emerson, 1983). Member checks by the key informant and other community members have taken place during analysis and writing. Questions arising about the representations I have made in descriptions of situations are negotiated with my key informant and others. I have reflected on these experiences in a journal over time to allow readers to make their own interpretations of the events as they view them.
3. The subjective and emotional experiences of doing fieldwork affect not only the interpretation made of the community studied but also of the researcher (Emerson, 1983). According to Emerson (1983), some researchers emphasize

that the subjective experience is not only a source of bias but also a source of insight and understanding. Wolcott (1995) says that balanced participation and distance must be managed. An extensive amount of time spent in the field interspersed with periodic absences has allowed me to balance participation and distance. This, again, is an ongoing process.

4. The ethnographer may not be sure how representative of a larger population the participants are. The researcher, however, does have a deep knowledge of a particular community. The scope of the ethnographic study is distinctive, being that of a holistic approach. Active involvement in a small community means that the community teaches the investigator. This type of learning differs from analysis of responses viewed in a detached way; indeed, ethnography cannot be completely objective (Peacock, 1993). I do not generalize this study to other Amish Mennonite communities, although I may compare my findings to those of others who study such groups.
5. The pressure for going native is a primary concern for the researcher. Therefore, balance must be maintained when the researcher is confronted with submersion into another culture (Wolcott, 1995). A constant dialogue with other researchers has helped me maintain my goals and research agenda.

Anthropologists try to control for researcher bias in the following ways:

1. To systematize the research process so that the categories of the system rather than those of self are predominant. Researchers use questionnaires, tests, charts for categorizing observations, and concept mapping (Peacock, 1993). I have constantly shown my data, categories, and interpretations to my committee for feedback. They have shared thoughts, materials, and articles to help me formulate and reformulate my categories.
2. To make personal bias explicit, to introspect openly so that the researcher becomes part of the subject of research (Peacock, 1993). Through my journal writing and my discussions with my committee members, I have tried to examine my research bias.

With these limitations, both specific to my study and to all ethnographic studies, researcher and reader can be aware of the context in which the following findings may be viewed.

The Setting: Oak Knoll Community and School

The Oak Knoll Amish Mennonite school, situated in the Oak Knoll Amish Mennonite community, is located in the southeastern United States. The community has approximately 250 members. In addition to the school, the community has a church, homes, and several small businesses. The community is located in the northeast part of the county of Springhill. The county has a small rural town, Jonesville, with a population of 24,000 individuals. Springhill is predominantly a farm community with only eleven industries scattered around the county. From here on out, the Oak Knoll Amish Mennonite community may be referred to also as "the community."

This location provides a market for the products of the community, most of which are specifically related to farming. Jobs for individuals of Springhill County include farming, industry, business, and services. A large majority of the people in Springhill are local to the county. This return to rural life appealed greatly to the Amish Mennonites. They had been seeking to resettle from Virginia Beach, Virginia, to a more agricultural area. The Amish Mennonite community members jointly own several thousand acres of land. The acreage has multiple uses: grazing cattle, growing crops, and harvesting forest consisting of hardwood and pine. The majority of the Oak Knoll Amish Mennonite heads of households work in areas related to rural subsistence or to a craft requiring manual skills, directly or indirectly.

In the center of the community lies the church, with the school about 100 yards from the church. A baseball field separates the church from the school. A small beaten path has been created where Amish Mennonite adults and children walk between the two. Across the road is a small pond where the students can be seen fishing for bream. As previously noted, when the Amish Mennonites moved from Virginia Beach in 1969, the school-aged students attended public school in the Springhill school district. However, a year later, after the community workers built the church, accommodations were made to house the school in its basement.

Eventually, a school was constructed. Since that time, there have been additions. Initially, a metal building of 50 feet by 100 feet was added for more classroom space and a small indoor play area. Since then the building was enlarged to accommodate a fellowship hall and gym. An upper room was added and is used for the school music classes, taught without instruments, and by the women for their monthly sewing bees.

The school consists of three classrooms, a library, two storage rooms, girls' and boys' restrooms, and a kitchen. One of the classrooms is for elementary students. Another of the classrooms is for middle school students. The third classroom is for high school students. Each level has one teacher who is responsible for all subjects. The classrooms are colorfully decorated with bulletin boards having such themes as "Ring in the New Year with good resolutions" and "Stars for Memorizing" (see Figure 3.1). Windows located in each classroom allow the students to see outside. Every now and then, the students peek out to check on the weather, because most of the students walk or ride bikes to school.

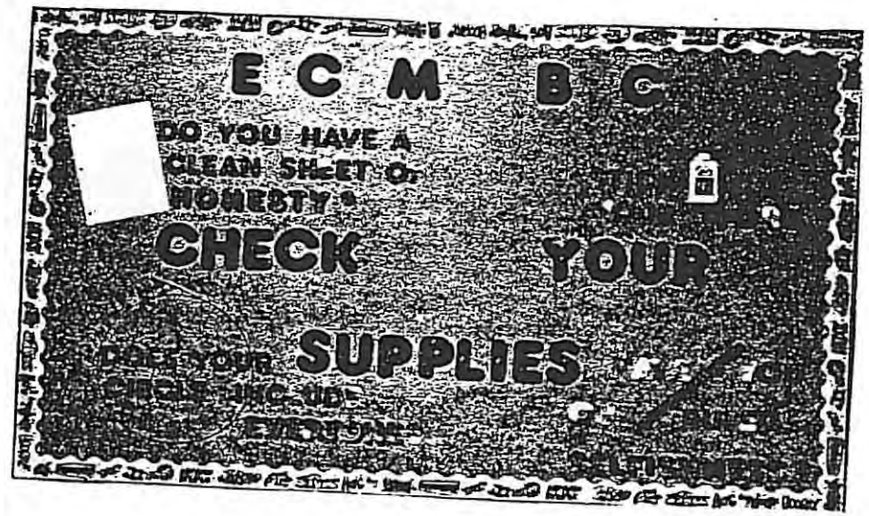

Figure 3.1. The values of this community are evidenced on their bulletin boards. Here honesty is discussed.

Figure 3.2. The reading machine is still widely used. The speed of the student's reading skills are recorded and evaluated.

Between the middle school and high school classrooms is a folding door, opened each morning to allow all the students to join together in morning devotions. The library is near the classrooms. It is very small with a hodgepodge of books that have passed censorship by one of the members of the school board or the principal. Also in the library are two ancient reading machines still in constant use (see Figure 3.2).

The Teachers' Views

Traditionally, many of the teachers are from families whose members have also been teachers. Harmony, the elementary teacher, was born in Sarasota, Florida. She is twenty-four years old. Harmony was three when her family moved to the community. She remembers of her childhood,

> Florida was becoming more full of people and this community seems to be a bit more country. All of my growing up memories have been made in the house we live in now, which has caused this place to be very special to me.

She continues speaking of her feelings about teaching,

> I went to our Christian Day School and had my own dad as my high school teacher. That made a special bonding to my dad in that area. Having my dad and sister in the classroom as teachers made our family very aware of the activities of school. Hearing their "teaching stories" created an interest in me to become involved in that also. I love working with the young children.

Harmony has a special bond to teaching and was constantly involved in the atmosphere of the school as she was growing up.

Ana is the middle school teacher. She is twenty-two years old. Ana and Harmony are the principal's children. Ana shares her memories of teaching:

> As a teacher with our individualized curriculum I was responsible for all the subjects. The books were to be self-explanatory, and I, as a teacher, was there to give assistance when needed. I do not spend time studying lessons to lecture

because the curriculum is not set up that way. The time the students spend on each subject is fairly equal. Math probably is more time-consuming.

As for her philosophy of life, she comments,

> I am a Christian and love the Lord. My desire is to be more like Him and be a witness to all that I meet. I want them to see God's love shining through. I want to have an expression of peace and joy! Many times I fail in this, but God is so merciful and gives grace to do better. In this troubled world a life of peace is invaluable. I am trying to live in God's presence all day, everyday.... Maybe this isn't the description you wanted of myself. It's more of a spiritual description than physical.

In the following written excerpt, both Ana and Harmony describe how students who enter their school learn to read:

> When the first grade students come to our school, they do not know how to read. Some barely know how to write their own name. The first week or so of school is spent doing some basic cutting, pasting, etc. Very soon we start teaching the sounds of the alphabet. We do not look at the alphabet as "26 letters," but one letter at a time. Since every word must have a vowel in it, we start off by teaching the vowels. After the vowels have been introduced, we teach the rest of the sounds. We do not teach them in order like they come in the alphabet, but rather we teach the letters that are more commonly used in words: t, s, h. m, n, etc. Letters like q, z, x, etc. are taught more at the end. As soon as they have learned the vowels and about two or three of the consonants, we put simple three-letter words together. They learn to sound out those simple words. The longer they do that and the more letters we teach them, the harder the words are that they sound out. Before they have learned all the sounds for A through Z, they are able to sound out pretty many words. As soon as they have learned the entire alphabet, we teach the consonant blends, diagrams, etc. About

> half way through the school year they are ready to begin their reading books. The first book is very simple with a lot of the words and phrases repeated. Along with their *Reader* is a workbook that they fill out with the stories. The first grade is primarily focused on learning to read and to do math. Those are the two main subjects that need to have a good foundation in order for them to be more successful throughout the rest of their school years. If they have not learned real well the basics of reading and math, they will find school hard for them. Once they get into grade three and higher, we bring more attention to science and social studies, or history. They have science and social studies in first and second grade, but that is not their priority. When those young children come into first grade, they learn more than just their books teach them. They can easily pick up their teacher's mood, attitude, etc. They also are a lot easier to break a habit of bad temper, bad sport in games, etc. They also can be taught to excel in areas that they are good in. Even in the primary grades the main focus is on reading and math.

The Amish Mennonites stress these two subjects all the way through formal schooling. The principal, Paul, mentions the importance of reading and math as it is directly related to the work place. As with all the other subjects, reading and the basics associated with it are taught by rote memorization and repetition.

Instructional Procedures and the School Curriculum for All Grades

From the beginning, the children sit in something they refer to as "offices," which resemble the cubicles found in libraries for quiet reading. where individualized instruction emphasizes the basic subjects of English, math, science, and social studies. Electives are added in middle and high schools grades. Included are accounting, home economics, New Testament study, Christian growth, the Life of Christ, basic art, general business, basic Spanish, geometry, literature, animal science, Bible reading, Old Testament survey, Old Testament church, history, health,

Figure 3.3. The subject of art is considered nonessential in the formal school setting. However, art is used to keep a student from getting too far ahead of other students.

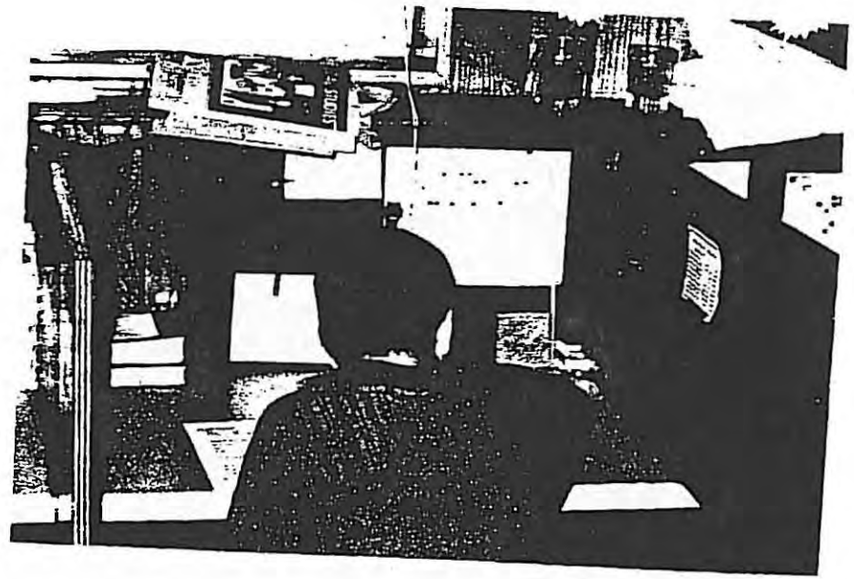

Figure 3.4. The office is the center for each student's learning. The youngsters individualize their offices. Note the chart with stars. A star is placed on the chart when a individualized learning packet is completed.

and typing (see Figure 3.3). Computer literacy has also been taught even when computers were not present in the school. The children sit in offices that have three sides so each student has uninterrupted privacy (see Figure 3.4). Each student has a chart for all subjects being taken and a box for a star documenting that the student has successfully completed an individualized book.

Individualized instruction packets are similar in form regardless of the subject or grade. For example, an individualized packet for chemistry consists of a factual reading text averaging thirty pages that includes content, objectives, pictures, diagrams, math problems, and a vocabulary list (see Figure 3.5). There is also a religious parable in the form of a story. This parable is under a subheading called "Teen Life Principles" where Amish Mennonite values are interwoven with the science unit. After working through a packet, the student takes a self-graded practice test. It consists of a combination of multiple choice, fill-in-the-blanks, and essay questions. Students who successfully complete the self-tests with a score of 80 percent are given a unit test by the teacher. Because of the abstractness of the chemistry presented, there is no inclusion of the usual biblical remarks in the reading. Quotes are attached separately in locations where they cannot be missed; for example, [they might have] "Keep your face to the sunshine and you will never see the shadows" and "But if we hope for that we see not, then do we with patience wait for it" (Romans 8:25). Other subjects, such as biology, include Biblical influences throughout the readings and questions. All the students personalize their offices with pictures, books, diaries, stickers, and such. Each office has a King James version of the Bible.

The students periodically test their reading levels and their reading speeds on a reading machine. Ana describes the oral reading that she implemented in the middle school classroom: "The third [through] sixth grade would have 'oral reading.' Each week we would read a story from their reading book, and then they had a work

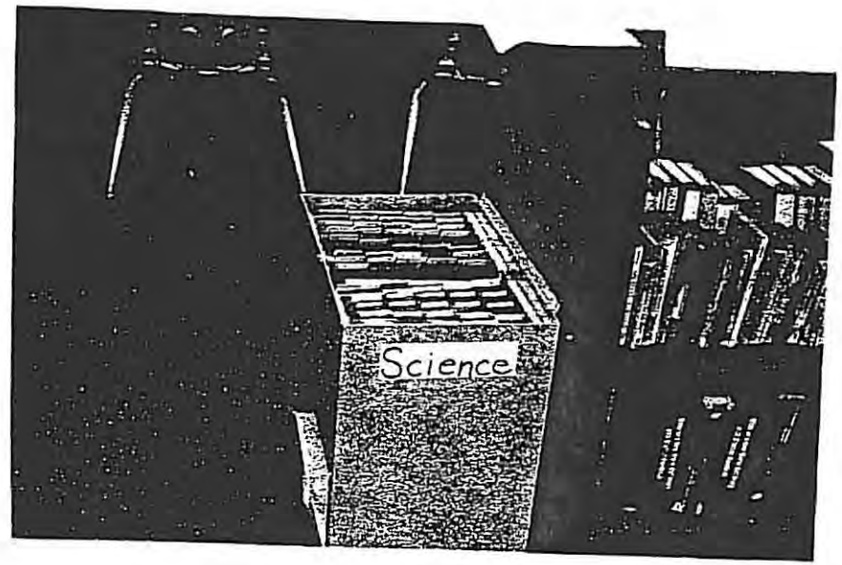

Figure 3.5. The supplementary materials for science are seen here. All science is taught from individualized learning packets.

lesson that went with it." In the following, Harmony comments on the method of reading instruction for the high school:

> The seventh through high school would use the reading machine. Each one would come to the reading room alone and sit in front of the reading machine with the story for that week. The machine speed was set before they begin reading. If they get a one hundred percent on their comprehension test, they would have their speed increased for the next week. I personally feel that reading orally in a group setting is the best. They have to read with more feeling and expression, and when you hear what you are reading, it can cause it to be more easily remembered.

Description of the School

In the main entrance of the school, an enclosed portable window display had one January, a variety of old tools used by the Oak Knoll Amish Mennonite community. Under each tool was a description of the use of the instrument. Another time the display contained pictures of birds, descriptions of the birds' nests, and ceramic likenesses of the birds. The main caption read, "Do you know your feathered friends?" Underneath it read, "But ask the Beasts, and they shall teach thee; and the fowls of the air, and they shall teach thee; Job 12:7" (see Figure 3.6).

The kitchen is a large area with modern appliances consisting of microwaves, stoves, and mixers, but no dishwashers. Mothers of students take turns preparing hot meals on Tuesday and Thursday of each week. A typical hot meal is fresh peas, rolls, finger Jell-O, homemade blackberry jelly, and macaroni and hamburger. On Mondays, Wednesdays, and Fridays the students bring their own food in paper bags or lunch pails.

The school year begins in August and finishes in May. Elementary school consists of grades one and two. Middle grades are three through six. High school is grade seven until all the individualized instructional units are completed. Some

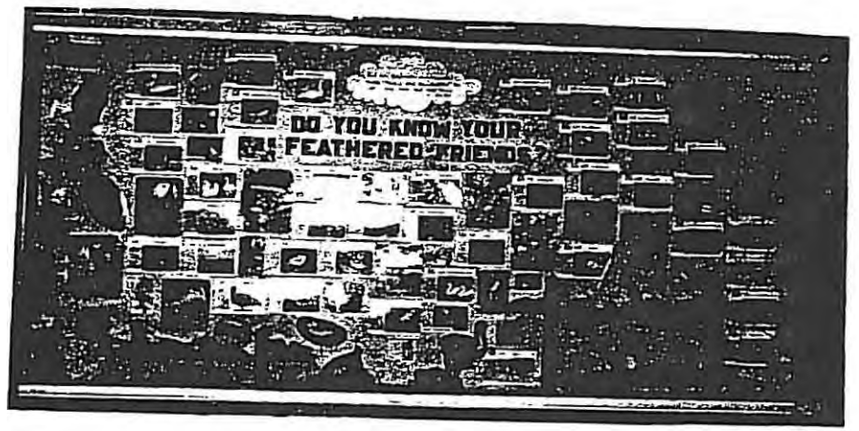

Figure 3.6. A display at the entrance of the school emphasizes nature and its relation to the Bible. Note the reference to the Book of Job.

students complete high school as early as sixteen. This school is not accredited by the Southern Association of Colleges and Schools, so it sets its own criteria for graduation. Students attend school Monday through Friday. School holidays include a week off for Thanksgiving, two weeks off for Christmas, and one week off for Easter. There are approximately thirty-five children in the school each year.

The children of Oak Knoll Amish Mennonite School complete their formal education when they have finished their required number of individualized packets for the necessary number of courses. For example, the middle school teacher completed her formal education at seventeen. The following school year she began teaching elementary school. No formal training for teacher education is provided or believed to be needed. The notion of education and formal schooling for the Oak Knoll Amish Mennonites is different from that of public school. The purposes of schooling for the Oak Knoll Amish Mennonites are to instill Christian values in the students and to train them for work (Interview, March 24, 1995). The students move at their own pace, so that the teacher becomes more of a facilitator. When a question arises that the student cannot answer, the teacher and students work through the problem together until they solve it. The community sees no need for formal training because the teacher and student work together to learn simultaneously. No lecturing, which would require preplanning by the teacher, is used.

Description of the School Day

School begins at 8:30 AM and ends around 2:30 PM. Each day begins with a devotion with all the students quietly listening to the "thought for the day." When this is completed, a firm but gentle nod is given by the high school teacher, and the students file quietly back to their designated rooms.

Students in middle and high school grades, as if programmed, ready themselves for the day. They begin by opening their learning packets and silently reading to

themselves where they left off the day before. This process continues without interruption, and no talking above a whisper is allowed. Students who have a question place a wooden red flag in a ready-made slot on their cubicles to get attention. The teacher carefully takes the flag down and places it beside the student. They discuss questions in a whisper, and then the student proceeds quietly to work. This pace continues with the only variation provided by students who go up to a podium to self-grade their practice tests from individualized packets.

Around 10:30 AM a fifteen-minute break begins with the ringing of the bell. The students refresh themselves by stretching, getting water, and walking outside. The bell is rung soon after for students to return to their work. With a nod by the teachers, the students quickly get back on task. They all begin quietly and without hesitation. This process continues until lunch break begins. A short prayer takes place before being dismissed for lunch.

Lunchtime, lasting about forty-five minutes, is quite a social gathering for the students. Girls hover together to talk of books or activities planned after school. The boys do the same. It is only the conversation and activities planned that are different. Afterward, the girls take turns cleaning off the table. The dishes are few because paper plates and cups are used. Most of the high school students, including the high school teacher, disappear for about thirty minutes to the sport location of the day between the church and school. The most popular sport is baseball. Two teams are randomly divided with the high school teacher always participating. Most of the girls play without shoes. On occasion, if the high school teacher, also acting as umpire, cannot see a close play, he asks one of the students who is in a position to see to call the play. The game continues until the bell sounds. Occasionally, a game of volleyball is played in the gym when it is cold or raining outside. Not all the students participate in this sport as they do in baseball. The younger children

participate in chase, Ping-Pong, and talking. These younger children pair up in smaller groups and spend more intimate time in conversations.

The students walk back to the school, freshen up, and return to work. The individualized instruction continues until 2:30 PM when school is dismissed for the day. Then the majority of the male and female high school students go to work. The boys typically have apprenticeship jobs in the community businesses. Some of the girls also work in the businesses as receptionists, while others help their mothers with work in the home. For the Oak Knoll Amish Mennonite students, when their formal education ends for the day, their informal education begins.

The Principal and Key Informant

Paul, my key informant, wears many hats in this community. His leadership ability has entitled him to a position of authority in the school (as teacher and principal), in the church (as a preacher), and in the community (as a leader). He says of his early life,

> My background was an old Order Amish home until I was nearly eighteen years old. I grew up in a rural farming community. My father had a sheet metal/welding business during most of my years at home.

In the early 1970s, Paul began working with my grandfather, James. My grandfather was the connection between the Amish Mennonite culture and my own. Because my grandfather was a farmer, Paul felt a kinship to him. This tie to my grandfather allowed me easy access into the Oak Knoll Amish Mennonite community school. Family ties are extremely important to the Oak Knoll Amish Mennonites.

Technology, in the form of machinery, was available to my grandfather. However, my grandfather lacked funds to buy modern equipment. Paul was and still is in the metal casting business. My mother and I frequently saw Paul patching up the hay bailer for one more season of cutting millet to make hay. Paul and my

grandfather had a very close relationship. Paul describes a corn grinder that my grandfather designed and Paul built:

> The corn grinder was run by a 1941 Farmall tractor. The tractor turned a belt which in turn ground up the corn. Then, the invention pushed ground-up corn into a galvanized steel holding bin that had two metal strips at the bottom, which would hand-release the corn into the troughs of the cattle.

My relationship with Paul has grown and changed. Even though we come from different microcultures with some values overlapping and some completely different, we have developed a trusting friendship. After being in the school and community for two years, seeing Paul as principal and high school teacher, I had to rebalance my relationship with him. In 1994 Paul was diagnosed with lymphoma. He still remains high school principal, but he gave up teaching. Paul says of his ten years of teaching experience, "These were some of the most rewarding and memorable years of my life. The opportunity to affect and influence young lives was a great challenge."

The School Auction

Once a year the Oak Knoll Amish Mennonite school holds an auction to supplement its income (see Figure 3.7). Although the church takes an offering for the school once a month, this is insufficient to cover the expenses. Many of the women donate handmade crafts, and the men donate hours of their time and skills. For instance, this may include an hour of bulldozing work. The auction is always held on a Saturday morning in September from 10:00 AM until 1:00 PM. Three hundred to 400 people from all around the area attend. A lunch plate consisting of barbecue chicken, cole slaw, pork and beans, and a homemade yeast roll is sold for $5.50. Also, a bountiful supply of desserts on sale for $0.75 allow people to sample the culinary art of the Oak Knoll Amish Mennonite women. Next to the lunch table is a special corner for youngsters. Items there include helium-filled balloons, cotton

Figure 3.7. The school auction serves many functions. The school raises a majority of its finances for the year. Socialization also is seen here.

Figure 3.8. The women are shown selling the goods they have made. The quilts in the background sell anywhere from $700 to above $1,000.

candy, and trinkets. A booth with crafts for sale is found. Handmade quilts are displayed around the walls of the auditorium (see Figure 3.8). Ten to twelve quilts with varying designs and brilliant colors are usually auctioned off for around $500, with the most intricate designs selling for $1000. One hundred percent of the profit goes to the maintenance of the community school.

Other Aspects of the School

A limited amount of competition is seen at the school. This is in keeping with the notion of members believing that each individual is equally important. For instance, no school sporting events or spelling bees take place. Even when the students play baseball, there is no set team, no scores are kept, and there is no consistent way of choosing the players' sides. As noted, some of the team members even help umpire. The Oak Knoll Amish Mennonites believe the time on earth is short, for their main agenda is to get ready for the afterlife. For them, spending time on competitive sports is wasteful. One of the middle school students says,

> We have been enjoying the nice weather by playing outside games like Prisoner's Base, Drop the Hanky, Flying Dutchman, Cat and Mouse, and others. Our class went to Ruth's store for ice cream a couple of weeks ago. My favorite subject is math. Miss Arloa's class let balloons go with their addresses and zip code on them. (Document, February 12, 1997)

One of the high school students talks of school,

> School has been in sort of a monotone stage since Christmas vacation. Not much has been happening around here other than an honor roll trip to [name of town] Chamber of Commerce. From there they went to [name of town] and ate at Ryan's [restaurant] and did some shopping at the mall. We've been enjoying nice warm weather and have been playing outside games like Prisoner's Base and Steal the Stick. We hope the ball field dries off soon, so we can start

> playing softball. Thanks to those that helped dig the ditch in the ball field. Hopefully, it will help dry it off faster.

Students, regardless of the age, enjoy sports. For them, it is a time of socialization, especially when competition is not a factor.

One important part of the day for the students is participating in music. Each classroom takes a few minutes several days a week to practice with a volunteer adult woman from the community. All singing is done *a cappella.* The emphasis on music is for several reasons: to practice for events at church like Christmas caroling, and to reinforce through words the values and belief system of the community. The music room is also where the community women work together on their quilts.

Conclusion

This region in which the Oak Knoll Amish Mennonite community relocated is primarily an agricultural environment. Viability is tied directly and indirectly to the manufacture of goods and services in this area. The Oak Knoll Amish Mennonites have reestablished themselves here and have maintained their culture for about thirty years.

As I have previously said, my goal in this endeavor is to add to the understanding and knowledge of science and science teaching. I have chosen a microculture for examination of their concepts and methods of teaching about science and technology. An ethnographic approach and methodology allows a holistic view of the multifaceted school agency and its relationship to the community.

Because anthropology favors a soft focus, I borrow from this discipline to come to an understanding of my questions about science. Peacock (1993) writes,

> Lest they perceive too sharply any single object while missing its place in context, anthropologists peer broadly, trying to glimpse foreground and background all at once, even including themselves in the picture. (p. 114)

My purpose in this study is to expand our vision of how others see science and technology. Only through this vision, by seeing others with broader lenses, can we see ourselves, the science community, with a sharper focus.

I now begin my study with focusing the lens to represent a small religious community. I do this by using tools just like that of a photographer: interviews, journal notes, description of school, pictures, and artifacts.

CHAPTER IV

THE OAK KNOLL AMISH MENNONITE SCHOOL

What follows is a description of the Oak Knoll Amish Mennonite School. This is a representation of how science is taught in this small religious community school. The narration provides an in-depth view of the process of teaching science as seen through the eyes and voices of community members including students, teachers, and parents, supplemented by my observations.

The following topics are covered in this chapter: the science curriculum, the science teachers, the students, modes of instruction, and classroom management. The high school science curriculum consists of courses in physical science, chemistry, biology, and physics. However, no student to date has opted to take physics. The elementary school and middle school science curricula consist of general science. This general science increases in detail as the student progresses through school. The mode of instruction is individualized for each student, and the courses are organized into units; eighteen secondary units must be completed for graduation from high school. Classroom management is based on a list of rules for conduct. These rules are posted throughout the school. After a thorough discussion of Oak Knoll's approach to science, I compare it to present day public schooling in the United States.

The Oak Knoll Amish Mennonite school uses the Accelerated Christian Education Curriculum. Speck and Prideaux (1993) report that this curriculum is used in many fundamentalist private schools and home schools. The Oak Knoll Amish Mennonite science curriculum, as with all the other subject matter curricula, is selected to conform with the religious beliefs of the community; specifically, the curriculum conforms to the community's interpretation of the King James version of

the Holy Bible. It is their way of knowing. The difference between public school science and that taught at Oak Knoll lies not in the content but in the position of the Christian Mennonite God as instrumental in each scientific concept explored. Speck and Prideaux (1993) found in the area of science that the curriculum is not in compliance with accreditation requirements for private schools and is designed solely for the maintenance of religious conversion. The Bible influences all areas of community life. All of the typical science subjects, except evolution in biology, are included in the Accelerated Christian Education Curriculum. No labs or other reinforcement of ideas are used because the mode of instruction is individualized as well as programmed. Typically, the public high school science curriculum consists of courses such as physical science, biology, chemistry, and physics (National Research Council, 1996).

The Public High School Science Curriculum

In the following, I examine the public high school science curriculum. High-school science students develop the ability to understand macroscopic properties of substances previously studied as well as microscopic structures of substances. This understanding obligates the student to conceptualize the observable macroscopic world, the microscopic world of molecules, atoms, and the subatomic particles, and the symbolic and mathematical world of chemical formulas, equations, and symbols (National Research Council, 1996). This relationship between properties of matter and their structures is an integral part of high school physical science. Laboratory investigation of the properties of substances and their changes through a range of chemical interactions provide the student an understanding of a variety of reaction types and their applications (National Research Council, 1996). Comprehension of the principles of matter can be supported by laboratory

experiences using forces, motion, vibrations, waves, light, and electricity. The following lists are central concepts in conventional public high schools science.

Physical Science

Physical science (Heimler & Price, 1989) covers these main topics: physical science fundamentals; force and energy; the laws of motion; energy; heat in the world; machines; solids, liquids, and gases; classification of matter; atomic structure and the periodic chart; chemical bonds; elements; carbon and organic chemistry; solutions; chemical reactions; acids, bases, and salts; waves and sound; light; mirrors and lenses; electricity and magnetism; radioactivity and nuclear reactions; and energy applications. When I taught physical science, I introduced these topics and reinforced them with demonstrations and labs. For example, in explaining motion we used blocks, pulleys, and springs. Another example I used for demonstrations included using dry ice and helium to explain states of matter.

Chemistry

Chemistry (Tocci & Viehland, 1996) usually includes the following: the science of chemistry; matter and energy; atomic structure; periodicity; chemical equations; stoichiometry; ionic compounds; covalent compounds; causes of change; gases and condensation; solutions; chemical equilibrium; acids and bases; reaction rates; electrochemistry; and nuclear chemistry. Included in the chemistry curriculum are investigations such as finding the percent composition of hydrates and separating mixtures (Tocci & Viehland, 1996). A consumer focus, a section on science, technology, and society, and a historical timeline may be added to the curriculum. In chemistry, typical labs were done in my classroom at regular intervals. Many of the concepts such as periodicity, chemical equations, and atomic structure were reinforced by playing games or making models.

Physics

Physics (Murphy, Hollon, & Zitzewitz, 1986) may contain the following list of topics: the nature of physics; a mathematical tool kit; motion; velocity: acceleration; forces; vectors; motion in two dimensions; work, energy, and simple machines; energy and thermal energy; states of matter; waves and energy transfer; sound; light; reflections and refraction; mirrors and lenses; diffraction and interference of light; static electricity; electric fields; current electricity; series and parallel circuits; magnetic fields; electromagnetic induction; electric and magnetic fields; quantum theory; the atom; solid state electronics; the nucleus; and nuclear applications. A laboratory manual is provided to match activities to text material (Murphy, Hollon, & Zitzewitz, 1986). Physics labs to demonstrate concepts are complicated and costly. Schools have limited budgets to purchase physics equipment to demonstrate or use for one lab for one year. The lack of labs cause the teacher to become very creative. However, labs involving mirrors, lenses, sound, light, and simple circuits can easily be used and reused in many activities.

Biology

In high school, students' comprehension of the concrete knowledge of biology is expanded by adding more abstract knowledge and more comprehensive theories. These include the structure and function of DNA and evolutionary theory (National Research Council, 1996). The National Research Council explains the importance of understanding life science:

> Because molecular biology will continue into the twenty-first century as a major frontier of science, students should understand the chemical basis of life not only for its own sake, but because of the need to take informed positions on some of the practical and ethical implications of humankind's capacity to manipulate living organisms. (p. 181)

The general biology curriculum (Biological Science, 1992) also has standard topics: the web of life; populations, communities, and ecosystems; matter and energy in the web of life; continuity in cells; continuity through reproduction; continuity through development; continuity through heredity; continuity through evolution; ordering life in the biosphere; prokaryotes and viruses; eukaryotes: protists, fungi, plants, and animals; the human animal: food and energy; maintenance of internal environment; coordination; the flowering plant: form and function, maintenance and coordination, behavior, selection, and survival; ecosystems of the past; biomes around the world; aquatic ecosystems; and managing human-affected ecosystems. Features (Biological Science, 1992) may include articles on famine in Africa, the cheetah on the way to extinction, or biological anthropology.

In recent years, the public school has seen changes in modes of instruction and the use of themes such as a unit on tropical rainforests (McConney, 1994). The core of such a unit is investigating a simulated environmental problem--requiring students to develop alternatives and then decide on a solution, having explored the class activities and discussions pulling from both the physical and biological sciences (McConney, 1994).

Oak Knoll School's Science Curriculum

Science is an attempt to understand the world around us. These Amish Mennonites accept secular science as a way of knowing only to the extent that it is consistent with their religious convictions. For example, DNA replication is studied, but only within the understanding that God's hand created DNA replication. Science, for the Mennonites, is a list of facts from the literal translation of the Holy Bible, an explanation for creation, the great flood, and their other significant stories (see Figures 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, and 4.7). Many Amish Mennonites may be considered theistic evolutionists. They believe God explains the why and science

Figure 4.1. Day One.

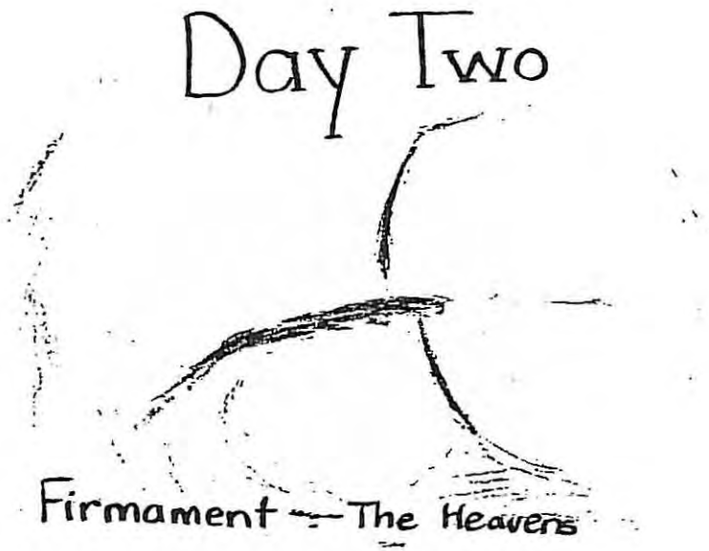

Figure 4.2. Day Two.

Figure 4.3. Day Three.

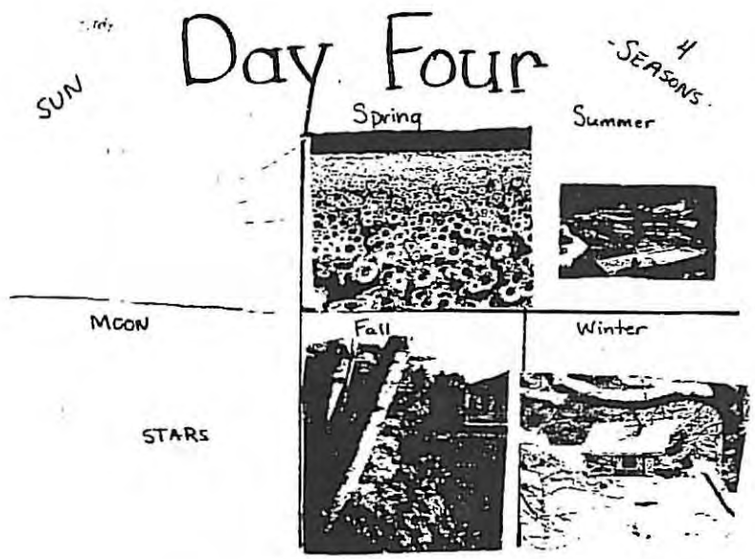

Figure 4.4. Day Four.

Figure 4.5. Day Five.

Figure 4.6. Day Six.

Figure 4.7. Day Seven.

explains the how. When they take this position, their science becomes compatible with their religion. For example, the Accelerated Christian Education Curriculum (1996) says science is "man's" organized knowledge of God's creation.

> This scientific knowledge is *attained* by observation, experimentation, and theorization. Although science attempts to know the infinite God and His Creation, man's scientific theories are not always correct because his knowledge is finite. If man understood science perfectly, a science text printed in 1990 could still be used today, but even those published 20 years ago are obsolete. It is obvious, then, that science has limitations because of man's limitations. (p. 7)

In this curriculum, science becomes a way of knowing, specifically knowing their infinite God. Therefore, the limitations of science occur because of humanity's limitations. The Amish Mennonite's reasoning becomes a circular form of knowledge: human understanding of science has limitations and science limits human understanding.

The Accelerated Christian Education Curriculum (1992) mentions these limitations of science:

> One of the limitations of science is that it deals only with the physical world. Science can tell us much about the physical world, but nothing about the spiritual.... The universal non-existence of something is impossible to prove scientifically.... Science may discover a wonderful new source of energy, but it cannot offer any moral guidelines for an understanding of how the universe changes.... Science may tell us <u>what</u> happens and <u>how</u> it happens, but it is never fully able to answer <u>why</u> it happens. (p. 8)

These limitations are perceived as a justification to turn to a God for an absolute, unchanging standard. Science is seen as leaving many unanswered questions. The

idea of theories is discussed in the Accelerated Christian Education Curriculum (1992):

> True science will never contradict the Bible because God created both the universe and Scripture. Some scientists may, like the early philosophers, contradict the Bible because their interpretation of their observations or their philosophical *presuppositions* are wrong, but the Bible, God's Word, is infallible. If a scientific theory contradicts the Bible, then the theory is wrong and must be discarded....Neither evolution nor Creation can be proven scientifically. Each is a position of faith. If you believe the theory of evolution, you do so by faith and not because of science. In fact, if you believe in evolution, you must disregard much scientific evidence because it does not fit with your theory. If you are a Bible-believing scientist who examines both views in the light of Scripture, you must put your faith in Creation because it agrees with scientific evidence as well as with what God has revealed to us in His written Word. (p. 9)

Their God's word is seen as infallible. If a scientific theory does not comply with their understanding of science that comes from the Bible, it is dismissed. A common belief of creationists is that evolution is seen as faith. They are willing to recognize science activities as testable, reproducible, and experimental, but they deny the legitimacy of any results. Again, their science must be in unison with the Bible.

Examples from the written curriculum used by Oak Knoll illustrate the interdependence of knowledge and belief that the secular community typically assigns to the categories of science and religion. The Accelerated Christian Education Curriculum (1992) discusses evolution this way:

> Evolutionists attempt to demonstrate that life evolved from lower forms of life. This is their academic justification for their unbelief and refusal to bow their knee to the divine, righteous Authority and declare obedience to Him....God

> fashioned every living thing perfect and complete without relying on "primitive ancestors" to complete the job. While the Bible and men's theories often disagree, scientific facts and evidence always agree with the Bible. (p. 30)

In chemistry, the integration of science and religion is more complex. Chemistry is generally taught in abstract rather than concrete terms. Text is usually separated from the proverbs. For example, when students study chemical reactions, they also read a proverb in the upper left corner of the page entitled "Wisdom." It reads, "Even though there are limiting factors in chemical reactions, there are no limiting factors in the power of Almighty God" (Accelerated Christian Education Inc., 1992, p. 30). This illustrates that in both chemistry and biology the Oak Knoll Amish Mennonites, consistent with the Accelerated Christian writers, believe that Christian values of creationism and their God's creative hand not only set things in motion but also continue to steer all of life's changes. They also believe their God makes no mistakes--as suggested when their textbooks discuss damaged genes. They believe their God is the supreme being.

One of the chemistry units involves learning about the periodic chart of the elements. In the middle of one of the sets that contains the words "metal hydride," "binary," and "hydrocarbon," appears the word "noreprinephrine," a hormone that is a tranquilizer and a neurotransmitter. Norepinephrine is the only reference to a medicinal drug in this particular learning packet. What does this inclusion suggest? References to medicinal drugs are few and far between in other chemistry and biology learning packets. The Oak Knoll Amish Mennonites use and respect the secular medical world. They want their children to be introduced to terms superficially so they can recognize the medicine, if, for example, a doctor prescribes such medication. Medicine is regularly used by the Amish Mennonites. In many cases, the Oak Knoll Amish Mennonite individuals combine herbal and secular

medicine. However, no evidence of this common practice, except an occasional word of medical terminology or definition, is found in the science curriculum.

The following passage is taken from the biology activity packet. It discusses the transmission of the creationist theory and attempts to disprove evolutionist theory:

> The Bible states that God created all animal life complete—whether simple or complex. Evolutionists refuse to believe this simple truth. Evolutionists will continue to search in vain for nonexistent fossils of ancestors of invertebrates and other animals to try to disprove God's word. Evolutionists attempt to demonstrate that life evolved from lower forms of life. (30-31)

For the Oak Knoll Amish Mennonites, this passage suggests the scientific community's academic justification for their disbelief in creationism. Therefore, the scientific community is on a pointless search for the true origin of life.

Likewise, in the following an excerpt from the biology curriculum presents the concept of genetic alterations (Christian Accelerated Education, Inc. 1992):

> In this life, God allows some children to be born formed differently because of changes in the genes.... Genes were created by the wonderful Creator who made all things well. God made genes very stable and dependable. They faithfully do their jobs without *mistakes*. Sometimes, however, a change takes place in the structure of the genes. This change, or alteration, can be caused by many things such as an invasion of the cells by a virus or a chemical, or by lack of nourishment to the cells. (p. 51).

The passage reveals a conflict of thought about how genetic mutations arise. The Amish Mennonites are willing to recognize that changes do take place in genes, causing genetic variation. However, the Amish Mennonites interpret this variation differently. The Oak Knoll Amish Mennonites believe their God makes no mistakes. For the Oak Knoll Amish Mennonites, a child who is born with a genetic deficiency

such as Down's Syndrome or Klinefelter's Syndrome is seen as a special gift from God. The person is treated with extra care by the community. The science curriculum that supports such views is guided by the teachers in the classroom.

The Teachers

In the following interviews the Amish Mennonite teachers Mark and Paul talk of a plethora of issues including their philosophies of science, technology, discipline in their school, values and beliefs, and religion among the Amish Mennonites and in the secular world. Mark's and Paul's ideas provide a glimpse of the type of philosophies about science prevalent among individuals in the Amish Mennonite community.

Paul

In my first interview with Paul, we discussed his teaching, his science curriculum, and his philosophy. He says science is "that which reveals His creation." In another interview, Paul discusses applied science or technology:

> Whether we are involved in agriculture or anything, it has become more scientific. That it is well for our students to know about things like nitrogen that they need in the soil and for things to grow. And they need to know about some of the medicines that they will use for their cattle. They need to know about hybrids and improving their breeding stock. They need to know these. You know, in the past it wasn't so important.

This view contrasts with the messages in the biology science curriculum. Paul sees the technological importance of science when applied to the economics of chemical and genetic improvements. His comments show how technology justifies science in the community. Paul continues by giving other examples of practical technology issues that, again, stress technology's economic importance to the Oak Knoll Amish Mennonites:

> You need to work on something that we don't know for sure. Like, why is it that pecan trees don't bear heavy crops each year. [In general] apple trees do, orange trees do, they consistently bear year *after* year the same big crop. The students have to understand some of those things. If you are building a wood stove today, you need to know such things as BTU emissions standards.

Understanding the practical side of science is imperative for Amish Mennonite economic survival. The genetics of crops and guidelines for BTU emissions standards are deemed important information to know.

Among the sciences Paul has a special interest in astronomy. He notes that he has been interested in the subject since he was a small child. The following are his thoughts on the Hubbell telescope:

> A number of various different scholars have decided how many stars there are. Today we are saying that the Hubbell telescope can't count them [the number of stars]. It is said in Jeremiah, "As a host of heaven, [the number of stars] cannot be numbered." We have been saying that there were 1000, but it's closer to 1600.

Paul explains that the Hubbell telescope cannot be used to document the number of stars. He suggests instead to look at the book of Jeremiah for the answer. Paul sees secular science often as being pointless. He alludes to the waste in designing a Hubbell telescope when information about the number of stars is already found in the Old Testament. Again, this "scientific fact" that he shared comes directly from his Bible.

Paul continues to discuss what he knows about the water cycle and the shape of the earth with Biblical references:

> Yes, it wasn't long [ago] that we discovered that the water runs downstream, goes out in the ocean, evaporates, and goes to the sky. Then it comes down from the sky in the form of rain. Okay, it says all water runs into the sea. Yet

> the sea is not full. Unto the place from whence the rivers come that they return again. All things are full of labor. Man cannot utter it. The wind goeth toward the South and turneth around about unto the North. But for a long time, they would fall off the earth.... Job says, "What he maketh small drops of water, to be poured on rain according to the vapors there of clouds which the clouds do drop and be upon man abundantly. This is the cycle thing again."

Paul believes that all scientific questions are answered in scripture. He sees large questions such as the water cycle explained; however, he does not discuss the mechanism behind the larger answer. For example, he does not use the term "evaporation," "precipitation," or "run-off." Instead, he sees his God controlling the water cycle and cites the book of Job that says God made the raindrops and pours rain on the earth "upon man abundantly."

Mark

I asked Mark about the relationship between science and technology. He explained that

> I do not see it totally detached from science, but there are some of our people that view technology as an evil. I think that if you went across the broad spectrum of Amish Mennonites, everything from Amish to Mennonite, you would find a very diversified people. As far as technology, they find ways of accomplishing things that make you sit back and marvel at times. I have a computer that I use personally at home; in fact, I just did all my taxes. I do word processing, all my Bible study. Some of my people take a position of no computers, even for business, and others just limited to business. Videos are the same things. Computers are something that I am promoting, especially [for] the students. I see that as something that all of our businesses, most of the businesses in our church, already are using a computer. So the students should

be familiar with it. They will pick [it] up on their own, because I had to read and play with it, so I became familiar with it.

Like Paul, Mark sees technology as related to but not the same as science. He explains that some Amish and Amish Mennonites see technology as "evil"; however, he sees technology as neutral. Mark values the use of technology. He, like other Amish Mennonites in this community, devises a way to filter the technology into the community and mentions incorporating computers in the school:

> We are considering changing our reading program, because our's is outdated. We are thinking about putting it all on computer. We could have it score their vocabulary and comprehension. It moves them on to the next level.

Mark sees computer technology as benefiting the student. He considers computers as being important to the reading program and useful for time management. He talks about the relationship between science and technology:

> In my earlier years in teaching, I taught science in 1978 out of [a] textbook called God's Orderly World. What that was showing the students [was] that there was a Creator that put it all together, so the Periodic Table of Elements were [sic] structured like they were. Everything has an order, so He could predict that there were elements there, instead of a chaotic system that fell together. I would see God as the Creator and science as the study of the Creation, which is confirmed, then, by scripture.
>
> Most of our people see science as nature and actualities. They differentiate between science and technology. My definition of technology is taking that which we have at our disposal and organizing it and structuring it and coming up with tools or means or techniques to help us accomplish what we want to accomplish.

Mark is creating his worldview from the complexity of the relationship between science and religion. His God sets everything in motion. Therefore, science is seen as the mechanism to put "nature" into motion. Mark suggests this can be proven by the Bible. He uses the periodic chart as an example of God-made order. Mark sees this order in opposition to a chaotic system of existence. Like many Oak Knoll Amish Mennonites, he sees technology as using what is available and organizing it to produce tools to help accomplish tasks.

Because science and technology were the central focus of my questions, most of the teachers' commentaries had to do with science and its relationship to religion and technology. One position the Oak Knoll Amish Mennonites constantly emphasize is that science comes from their religion, cannot be questioned, and is a matter of faith. Again, religious faith guides the teaching of science and controls the curriculum taught. The values and belief system of the Oak Knoll Amish Mennonites are embedded in each lesson at each grade level.

The Students

Also representative of the thoughts of the Oak Knoll Amish Mennonites are the high school students Rod and Marshall. An interview with these two young men gives insight about students' thoughts on issues of science and technology. Both of the students are presently attending Oak Knoll Amish Mennonite community school. They both agreed to be interviewed. I picked Marshall and Rod up from school, and we drove to have an afternoon snack at the local McDonald's restaurant.

Marshall is biracial. He was adopted by an Oak Knoll Amish Mennonite couple along with four other biracial children. Rod's father Sam and I attended the same church and high school. When Sam was in the eleventh grade, he became very discouraged with the Presbyterian church. He started attending the Oak Knoll Amish Mennonite church and soon became a member. He later married Ana, and they have four sons and one daughter.

In the following conversation, Rod and Marshall talk with me about some of their thoughts of the future:

DENISE: What are you going to do when you finish school?

ROD: I'll help my dad on his mason job.

MARSHALL: I don't know. Find a job somewhere.

DENISE: Do you think you want your own business when you grow up or do you want to work for somebody else?

ROD: Work for somebody.

MARSHALL: The way my dad has it right now, I probably won't have my own business. He's the mason. He works for a contractor.

A predominant characteristic of the Oak Knoll Amish Mennonite community is that children have a sense of security and certainty about their future work. Job placement is not a worrisome issue. In this community, the responsibility for taking care of the youth, spiritually, personally, and professionally, belongs to the elders. The ownership of a business is not a concern to these two students at this phase of their lives. The reassurance and the comfort of the nurture given by community members to these students are always present. Some of this nurturing is modeled by the children with their pets:

DENISE: If you had a cow for a pet, could you kill that animal for meat?

ROD: If it's my pet, I wouldn't. But if it was diseased or hurt, I would kill it, to take it out of its misery. If it don't have no disease or anything, I wouldn't.

MARSHALL: I don't name my pets, but if I had a cow, then I might would eat it.

One of the Oak Knoll Amish Mennonites' basic beliefs is that God put animals on earth for human use. This idea has been transmitted from generation to generation. However, the value of the relationship between the animal and the child overrides the value of domination of animals.

Rod comments on the teaching style used in his classroom: "I don't like it.... English is just boring.... It can hardly be taught differently." One reason the students see English as boring is that it is taught by repetition. The students see no other way than to teach by repetition. They are accustomed to this instructional style. Marshall says, "We have it in books; it can't hardly be taught any differently."

When Rod talks of science, he sees the same problem: "We study gravity and stuff like that. But, it isn't something that I think about." The students see no connection between what is taught in class, "gravity and stuff like that," and real world applications.

The following is a dialogue in which Rod and Marshall speak of their belief in creationism:

ROD: It's impossible for anything else besides Creationism. God created it.

DENISE: What about you?

MARSHALL: Yeah, God created stuff on each day and that's how it came out.

ROD: Biology tells us about the animals and stuff.

Any other possibility is dismissed by these two students. The discussion is ended.

Rod reflects on the limitations of technology in his community. He says when he hears a radio, "I just tune it out." Then we laughed because a radio was playing in the background of the restaurant. Rod says the Oak Knoll Amish Mennonites do not prohibit computers, "just the Internet." If access to the Internet were allowed into the community, then children might be exposed to secular values.

I asked Rod to define "technology." He said, "I don't know how to say it. A make up of things." I asked Marshall. He said, "I don't know." The students' responses to questions about technology are very limited. Technology appears to be peripheral to their lives. However, the businesses in the Oak Knoll Amish Mennonite community have an abundance of technology, such as computers, facsimile machines, and photocopiers.

Then Marshall and Rod talked about their values and beliefs. Marshall talked about his family. He said, "I want to stay close to the church and family." Rod said that his strongest belief is "that God will come back and we need to be ready for that." The core values, religion and family, are perpetuated in the children. These values appear to make the young teenagers feel they are protected. This enables them to be nurtured. The belief in the "second coming of Jesus" is one of the core concepts that holds this community together.

Science and Its Relationship to Technology in the Oak Knoll Amish Mennonite Belief System

To reiterate, representing the Oak Knoll Amish Mennonite community view of science is the Oak Knoll Amish Mennonite elementary teacher who defines science as "God-made things" and technology as "man-made things to make life easier such as computers" (Interview, April 10, 1995). Paul says science is "that which is proved by the Bible" and technology is that which "takes what science reveals and makes life useful" (Interview, April 10, 1995). In the Oak Knoll Amish Mennonite community, religion is science. If asked the basis of their understanding of science, the Amish Mennonites would plainly respond: "faith." To maintain this "faith" in their culture, the Mennonites transmit values through all aspects of their lives including school, social settings, the home, the workplace, and the church. These values are instilled early in the formal school setting by the type of science curriculum chosen by members of the school board. These values are interwoven through the entire science program including biology and chemistry.

For the Oak Knoll Amish Mennonites, science is a way of understanding their world, but it can only be one way, consistent with their religion. It cannot be questioned because doing so would be questioning their faith. On the other hand, technology is seen differently. This community requires economic stability to sustain itself. Economic stability is dependent on markets and resources from

outside the community. Because of their dependencies on technology for economic stability, the Oak Knoll Amish Mennonites see technology as separate from science. They use many ways of knowing to develop new technologies or reconstruct existing technologies. Their view of technology is instilled early, beginning in the school. It is transmitted by teaching students that technology can be evil when not used for their God. This view of technology is exemplified by the students having no computers, videos, or televisions. In other words, the Oak Knoll Amish Mennonites attempt to model what they teach about technology. The elders know this must happen early in the stages of children's development. The elders attempt to protect the students and shelter them, so when they are exposed to secular influences, they make appropriate decisions.

The Mode of Instruction

The mode of instruction used for teaching science is individualized. This is similar to other models used in home schooling and Christian schools and is the teaching method used for all subjects and all grade levels. The students work on individualized learning packets at their offices until all work is complete. A self-test is taken prior to the unit test. Then the student is tested on the material with an instrument provided by the publishers of the learning packets and administered by the teacher. The student must correctly answer 90% of the test before proceeding to the next learning packet.

I was particularly interested in chemistry and biology. Because I have taught public school chemistry, I wanted to compare the Oak Knoll Amish Mennonite community's methods of instruction with those of the public school. I was also interested in studying the biology material to see how the creationist approach and evolution theory were handled. The following is an excerpt from my personal journal:

> How strange to see in the middle of a list of "water and its elements--physical properties of water" such statements as "Man is God's ultimate Creation" next to a statement that water covered more than 70% of the Earth's surface....In my experience students have much difficulty with chemistry because of the abstraction. It would surprise me if Amish Mennonite students had a deep understanding of chemistry. This is consistent with my perception of high school chemistry students in the public school.

After teaching in public school where the line is so carefully drawn between science and religion, I was thrown off balance being in the Oak Knoll Amish science classroom with a blending of science and religion. However, I was not surprised about the lack of profound understanding of chemistry because it is so abstract and difficult to be reinforced without visuals, experiments, or demonstrations. The material covered in the 1114 Activity Packet of science--the first two numbers representing eleventh grade, the second two numbers representing the unit, in this case, fourteen--is comparable to the information from the curriculum in a public school program. The following are some examples of the main topics covered: physical properties of water, chemical properties of water, electron dot configuration, polar and nonpolar covalent bonding, ionic bonding, characteristics of hydrogen, oxygen, nitrogen, sulfur, halogens, and noble gases, and references to brimstone in the Bible. Biblical references are interspersed from sentence to sentence. For example, one fill-in-the-blank sentence reads, "Because helium molecules contain only one atom, they are monatomic molecules." The next fill-in-the-blank sentence reads, "Walking with God should be a Christian's top priority." The rote memorization style of learning by each student makes teaching the complexity of chemical behavior difficult. Chemical concepts are more abstract than concrete (National Research Council, 1996). For example, students cannot see

the chemical mechanisms causing the reaction to happen; they can see only the results of a chemistry experiment.

I also question how much of this information is carried outside the formal classroom into the daily lives of the Oak Knoll Amish Mennonite students. From my understanding as a teacher the lack of labs, field trips, experiments, or demonstrations compounds the problem of understanding chemistry for each student. In the public school, chemistry lectures and discussions are usually followed by hands-on reinforcement of the concept. This is not the case with the Oak Knoll Amish Mennonites. They use only rote memorization in curriculum testing. The model encourages the transmission of unchanging values and a stable belief system, but has limitations for conveying what we know about the dynamic interrelationships of the natural world or how our knowledge is developed.

Another science educator accompanied me on one of my visits to the school. The following is an excerpt from the field notes that she recorded. Sarah shares her thoughts:

> I am astounded at the austere silence of the classroom. The silence is only interrupted by whispers of the instructors assisting students at their carrels. The room is large, and yet much individual activity is being carried on. The room is divided with younger children on the other side with [the high school teacher]. I notice many more boys than girls. There are centers in each section of the rooms where a couple (1 to 4 students) carry what appear to be their workbooks....They must be checking their own work. Students move freely to and from the center as needed. I don't see student-to-student interaction, only instructor-to-student interaction.

At one point I observed as Sarah picked up a biology textbook. Paul immediately showed her a booklet from the new biology program. Sarah put down the textbook to get a closer look at the program, and Paul immediately returned the book to its

shelf. Paul is extremely protective of the curriculum taught, which may possibly explain his reaction in promptly showing Sarah the new biology program.

Discipline

The rules for student behavior are established early and are consistent in all classrooms (see Figure 4.2).

Oak Knoll Mennonite School Learning Center Control	
1.	Only Self-Pacs may be taken to the scoring table.
2.	Score Keys may not be removed from the scoring table without permission.
3.	Work all activities and score Self-Pac completely before taking the self test
4.	The SUPERVISOR must initial the Self Test before the student may take it.
5.	Take only a pencil and eraser to the testing table,
6.	Students must raise his/her signal to acquire SUPERVISOR assistance.
7.	Keep your Goal Chart and Student Achievement Chart on display at all times.
8.	Students are not permitted to take resource books home without permission.
9.	Students are <u>not</u> permitted to communicate or leave their offices without permission.
10.	Students must get permission from the SUPERVISOR, rather than the monitor to leave the Learning Center.
11.	Turning around in office repeatedly is not to be permitted.
12.	Any damage to school or church property shall be paid for by the offending student.
13.	Supervisors' desks are off limits to students.
14.	Do <u>not</u> bring matches, knives, guns, radios, or cassette tapes to school.
15.	No chewing gum permitted in the schoolhouse or anywhere on the school grounds.

16.	All personal items and reading materials must be SUPERVISOR.
17.	Offices are assigned and changed only by the Su
18.	Offices are private. Please respect the privacy of others.
19.	Students are not to sit on offices.
20.	Keep offices clean. Do not mark offices or books.
21.	Students must stay on and around school boundaries. Do not enter the church house or the green building without permission.
22.	Sitting in vehicles and riding bikes while at school is prohibited.
23.	Violations such as quarreling, fighting, cheating, copying answers from score keys, or stealing is not permitted.
24.	Foul or profane language is prohibited.
25.	No scuffling or excessive physical contact between boys and girls.
26.	Disrespect for authority is not permitted.
27.	No throwing of hard objects that can be harmful to others (i.e. sticks, stones, and pine cones).
28.	Students must abide by school dress code.
29.	No griping.
Demerits and Detentions	
A student will be given a demerit and detained 10 minutes of break time for violating one of the above rules. Three or more demerits in one day results in a detention the following day.	
3 demerits = 20 minutes detention 4 demerits = 30 minutes detention	
5 demerits = 45 minutes detention 6 demerits = 60 minutes detention	

Figure 4.2. A listing of rules for the students followed by a list of the consequences for students' failing to adhere to the rules.

Students' behavior is a specifically manipulated form of control. Even the title "Oak Knoll Amish Mennonite Learning Center Control" uses the word "control." If a rule is broken, demerits are given and swift action is taken. The number of demerits dispensed depends on the severity of the offense. Paul explains that if a student continues to break the rules, a parent is then called in and is required to deal with the issue. The patterns of control are consistent in every agency of the community, not just the school. The school is only one example of such reinforcement and restraint. These restraints teach the parameters for behavior and reiterate the values sought by the Oak Knoll Amish Mennonites. The greater society also deals with this issue of control. Every community is responsible for providing parameters for its children. This protocol permits the children to know the limits of permissible conduct, to feel secure, and to know how to act in social situations. Of course, the Oak Knoll Amish Mennonite students break rules just like other students. If there is a severe infringement of the rules, the parent is immediately called to the school, marking a specific difference from public school practice. The parents and the teachers work very closely together to deal with issues of discipline.

Summary

The preceding chapter set the stage to introduce my research. A combination of the data collection, analytic induction, ethnographic analysis, and limitations of the study presents the lens from where my study originates. The general setting lays out the opening scenes of the school and community. This setting encompasses general perceptions of teachers, instructional procedures, a typical day, the principal and key informant, the school auction, and other aspects of the school. Specially, science and technology are studied.

Much of the science and technology learned in the school is interwoven with the values and belief systems of the community. The school mirrors the community and therefore becomes an extension of the church. School science focuses on a

historical account of God and the way he created and maintains the earth. In a more holistic representation of the community's science and technology, the walls of education must also encompass the businesses where much of the science and technology are used.

CHAPTER V

THE LINKAGE FROM SCHOOL TO COMMUNITY

As noted previously, I began with a study of science and technology in the school. I soon learned that understanding science and technology meant tracking them into the community. Technology is the link that connects the formal science instruction of the school to the science applied in the community. The Oak Knoll Amish Mennonite school in the Oak Knoll community supplies part of this link by endorsing apprenticeships offered by the community businesses. At first, I observed limited use of technology in the science classroom and the school.

Many definitions of technology are used (D. Jackson, personal communication, June 7, 1995). I had a limited vision of technology, considering it as only physical objects. In studying technology among the Oak Knoll Amish Mennonites, I had to move and reorganize my thoughts and construct an alternate definition of technology. In my science education I was familiar with several definitions. The word technology has different levels of meanings. First, at the most basic level, technology does refer to sets of physical objects--to cars, computers, or lathes. Second, technology refers to human activities, as well as to objects. Steelmaking includes what steel workers do, as well as the furnaces they use (Makenzie & Wajcman, 1985). Third, technology refers to what people know as well as what they do (Layton, 1993). Technological items are useless without the know-how to use them, repair them, design them, and make them (Mackenzie & Wajcman, 1984). Studying technology only becomes problematic when we expect the definition of technology to be uniform. All humans develop and use technology, but technology varies from culture to culture. Thus, a reevaluation of the notion of technology is needed. In this chapter, I discuss the relationships of technologies and

community businesses, technology and the church, and technology and apprenticeships. For each, I discuss the traditional Oak Knoll Amish Mennonite thinking as well as their modern adaptation of it.

Community Businesses and Technology

The Oak Knoll Amish Mennonite businesses must be flexible enough to adapt to a competitive business world. However, the businesses are controlled by the doctrine of the church. Even in earlier times, the implementation of technology was balanced with accountability to the Oak Knoll Amish Mennonite's God. This thinking requires a careful balance of religious ideology and economic priorities.

Traditional Thinking

The traditional way of thinking about technology is still followed in many Amish and some Amish Mennonite communities (Interview, November 10, 1985). In contrast, secular societies have developed powerful technologies and a certain way of thinking about technologies. Langin (1993) suggests that technological development is a driving force for social change as well as the central component of power politics. For many individuals in the secular world, the way of thinking about and usage of technology represents this economically practical application of science.

In contrast, the Old Order Amish emphasize a relationship among earth, God, and self. The Old Order Amish tend their fields with horse-drawn machinery, rejecting tractors and modern mechanisms. The Oak Knoll Amish Mennonites do use modern machinery. Even with modern machinery, the Mennonites favor simplicity over complexity. Therefore, given the choice of a modern air-conditioned tractor or an old model tractor, the Oak Knoll Amish Mennonites choose the older model because an "idle mind is the devil's workshop." The more physical the labor, the less leisure time that community members have. Leisure time is seen as an opportunity for mischief. The reasoning is that the

> Machines produce no manure...manure is recyclable, fertilizer for the soil. Land ought to be treated and developed so that parents can face future generations without shame for what they have done to the earth. Thus they have a sense of working in partnership with God, subduing the earth, with accountability to God and their community--past, present, and future. (Langin, 1993, p. 56)

Similarly, Oak Knoll Amish Mennonites view technology as a practical application of science but completely separate from scientific theory and ideology. Technology and its uses separate the Oak Knoll Amish Mennonites from the rest of the world. Technologies and their adoption or rejection can cause disagreements within an Amish Mennonite community. Such an argument led to the separation of several smaller communities from the main Oak Knoll community over the past ten years. For this group of Amish Mennonites technology allows them to take what science reveals and make life as serviceable as possible for their God (Interview, April 7, 1994). The Oak Knoll Amish Mennonites believe they use technology to better serve their God.

The Oak Knoll Amish community has for the past thirty years been extremely selective in adopting technologies. Radios, videotape recorders, video games like Nintendos and Segas, and television are prohibited. Computers have until recently been restricted to places of employment. Control is dependent on the values that are connected to certain technologies. Oak Knoll Amish Mennonites believe that "we use technology when we can control it, not it controlling us" (Interview, January 18, 1994). Oak Knoll Amish Mennonites maintain that order in their world as they know it requires enforcing control over technology. If control is not kept at all times, then problems, manifest in and surrounding the technology, may engulf them and change their community values. Their interpretation of technology is that

it is not only physical equipment but also all the values and beliefs attached to the equipment that inform their creation.

Emergent Thinking

Oak Knoll Amish Mennonites so strongly link technology with secular values that only on rare occasions, such as introducing computers into the school, is anything changed from their customary way of doing things. For example, two IBM computers with only word processing capabilities were added to the school's library in February 1998. Discussion surrounding the addition of these computers had been ongoing for ten years. This is an example of how change occurs in this community.

Adaptation and Flexibility

By defining themselves as fundamentalists, fundamental Christians, Oak Knoll Amish Mennonites believe they can filter technologies used in real-life situations. Filtering of technology comes from a blending of the practical with their values and belief system. These criteria are what Oak Knoll Amish Mennonites use to evaluate technologies before adopting them. Still, people in this community are industrious and creative in their application of those technologies adopted. For example, cabinet shop workers developed a new process and a new "machine," the double-sided stapler (see Figure 5.1). In other words, they developed a new technology to meet a need. Another example occurred when Alex, from the neighboring town of Jonesville, brought Paul an old Sears gasoline motor. Paul is known for his ingenuity in adapting new technologies to dated equipment. Alex wanted Paul to design and to construct something to run two ice cream churns at once. Alex planned to take the apparatus to festivals around the state. Paul was able to modify the gasoline motor to run both ice cream churns at once. This ice cream machine was demonstrated during the most recent school auction. However, these Oak Knoll Amish Mennonites refuse to patent their inventions because this

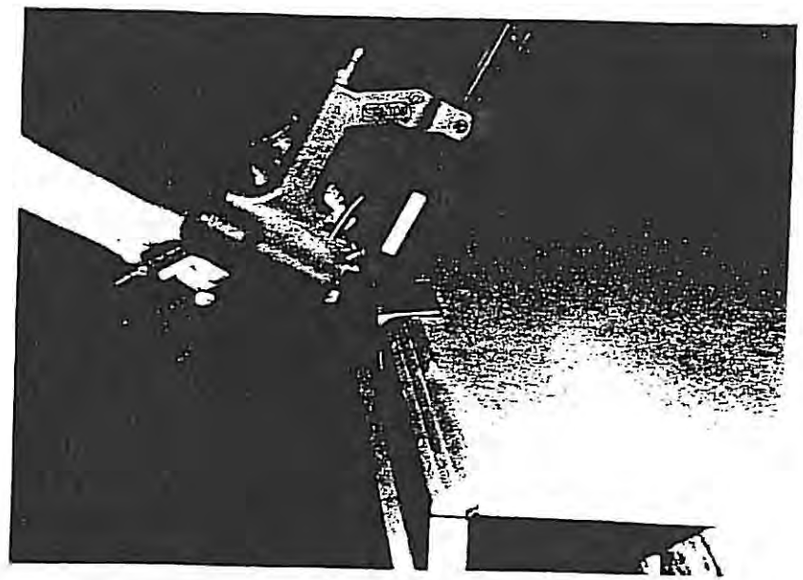

Figure 5.1. The double stapler is seen attaching the molding to the laminate.

risks overinvolvement in the secular world. They are prohibited from engaging in litigation. Defending a patent infringement may require litigation.

With the creation of a new design, an important aspect of United States secular business is to patent the product, prohibiting the design from being used without the inventor's permission. In 1790, the United States *Constitution* empowered Congress to establish a national patent system. This law gave Congress power to promote the progress of science and useful arts by securing for a limited time to authors and inventors exclusive right to their respective discoveries (Kingston, 1990). The United States Congress enacted the patent law protecting new, obvious, and useful inventions. This protection is for machines, devices, chemical compositions, and manufacturing processes. Congress also has enacted intellectual property regimes to accommodate a technology's peculiar features. This is an aspect of the treatment of technology that these Oak Knoll Amish Mennonites tend to reject.

Economic pressures and constraints rather than the desire for progress or enormous financial gain encourage Oak Knoll Amish Mennonites to see technology as separate from science. Community members adopt new technologies or reconstruct existing technologies. For instance, the double stapler and the electric ice cream machines were developed through a rudimentary experimental method. These inventions were seen as efficient technological developments. This inventiveness in technological development has much value. It aids efficiency. However, Amish Mennonite communities do vary in their approach to patenting. The less traditional the Amish Mennonites, the more they are apt to apply for a patent. I interviewed two such individuals. I thought by contrasting the conservative, middle-of-the-road, and liberal Mennonites, it would, in general, reveal the slow progression of modernization of the Mennonites. One business owner named Matthew represents a middle-of-the-road Mennonite, and another named Kim represents a liberal

Mennonite. Matthew attends the Silent Pines Amish Mennonite church that allows radios. It is fifteen miles from the Oak Knoll community. Matthew says he would procure a patent if the invention were to be distributed outside the Amish Mennonite community. He sees a patent both as conflicting with his religion and as not conflicting. Matthew compartmentalizes this issue by saying he would not procure a patent if the invention were used only within Amish Mennonite communities where patents are prohibited. However, if the invention were used in the secular community, then he would deem it necessary to protect his economic interests. Matthew says he knows of two patents owned by Oak Knoll Amish Mennonites—one is the New Holland hay baler and the other is a patented turkey call invented by his cousin in Colorado. His cousin sold the plans to a company to mass-produce the turkey call.

I also spoke to Kim, who is single and has owned and operated a restaurant for 23 years. Kim considers herself a liberal Mennonite. She did attend the Oak Knoll Amish Mennonite Church; however, she left and took with her only those values and beliefs she found helpful in her life. Kim has blended the Mennonite and secular world together. For instance, she has a television in her home. She said the United States government, its organization, its problems, and its participants' personalities fascinate her. Kim sees patents as necessary to provide security for her business. She says that her protection would probably not include patents on machines, but a form of protection on her recipes. Kim says, "We need to protect ourselves more."

Kim and Matthew have constructed more liberal solutions to handle technology than most members of the Oak Knoll Amish Mennonite community. They have incorporated use of some of the secular laws to protect themselves against such hazards as liability, infringement, and theft.

The Community Church and Technology

The church elders are the representative voice for the congregation in deciding what technologies are allowed in the community. One elder rotates on the school board every year, and the board disseminates these decisions and other traditions to the school.

Traditional Thinking

The strongest held of all beliefs have to do with religious teaching. These values and beliefs reflect the decisions community members make. These decisions are more strongly held in the church and are perpetuated through the extended arm of the school. If some question arises about, for example, changing the use of music in the church, more often than not, tradition prevails.

Emergent Thinking

Andrew Brubaker, a friend and guest speaker of the community church, reinforces and exemplifies the Oak Knoll Amish Mennonite ideology. Brubaker was chosen to give guest sermons by a small planning committee from the church because he represents their views. In a recent sermon at the Oak Knoll Mennonite Church, Andrew Brubaker commented about the ideological value of technology in the community:

> Is technology moral? Is there something about technology that has a way of taking over? Is there something innate about technology that is evil? Is it as some have suggested the modern Babel? Maybe the reason that man discovers and invents is that man is made in the image of God. Part of that means having his creative impulse. The reason that the West has developed technology is because of the Judeo-Christian base that has shaped our thinking. If we go to Scripture, there is nothing specific about technology. Technology in itself is neither evil nor is it good. We are under no obligation to use it. We should not be critical of those who choose not to use it. We don't have to be involved in it. And if technology is not evil or good, then we are free to use it as long as we do not violate our commitment to Jesus Christ (Recorded Sermon, September 1, 1995).

Brubaker is speaking directly to the values associated with a particular technology. He is speaking for the Oak Knoll Amish Mennonite community and the position the community takes on technology; this attitude cannot be generalized to other Amish Mennonite communities. Each community defines its position on the application of technology. This message, however, represents the voices of several hundred individuals in this community.

He continues to identify positive purposes for technology in the Amish Mennonite culture: meaningful for practical purposes such as transportation; useful for a simplified lifestyle; valuable for increasing productivity; and convenient, such as telephone communication and new technologies for translations of the Bible.

Brubaker, ironically, works for a computer company. He deals with the secular world daily. Brubaker notes that there are basic necessities to be met in the home, church, and business. Technology in some instances is seen as improving the quality of life. If technology can improve the quality of life, freeing more time to worship God, then that technology is allowed. Therefore, the Amish Mennonites' definition of quality of life differs from that of the secular world. Brubaker suggests choosing wisely. He simplifies choices by compartmentalizing decisions: either technology supports secular purposes or technology supports community values.

Brubaker poses certain questions to the congregation, "1) Will God put his signature to this [technology]?, 2) Will He give His blessing [for the technology]?, 3) Does the technology that we may want to use promote pure thinking according to reality [of the world in which they live]?" For the Oak Knoll Amish Mennonites the closer individuals come to pure thinking, the closer they are to God. Their reality is that God is the center of their being, and the purpose of life is to become one with

God. (Interview, October 27, 1998). Therefore, to attain pure thought, the community models what the Oak Knoll Amish Mennonites see as the exemplary life. The Oak Knoll Amish Mennonites believe that God has been the divine force for selecting their technology. They verbally model what they see as the highest form of pure thought. Brubaker continues to remark,

> Avoid the extremes. The two extremes that I see in this area are on the one hand wholesale rejection. To say technology is too tough for us to deal with so we are going to just throw it out and have nothing to do with it at all. It is being such an extreme. It is perhaps less dangerous than the other one that says wholesale acceptance. So on the one hand rejection and on the other hand acceptance. Somewhere in between there we have to balance those.

This balance comes with acceptance or rejection of technology depending on whether the technology is laden with secular values. He continues,

> But we need to balance the extremes of thinking technology is something great and something we just have to use or on the other hand of saying we don't want to deal with the questions. As we learn to find answers, we need to learn to balance personal responsibility with corporate accountability.

Brubaker believes in balancing practical technology with the maintaining of Amish Mennonite values and beliefs because modeling their beliefs in how they live is the most "Christian" thing to do. They take a position so as to avoid apathy. Because of their technological decisions, the Oak Knoll Amish Mennonites are questioned by some in the secular community who view them as being "eccentric."

Brubaker also describes what he views as five negative roles technology may play in the Amish Mennonite community: "1) to dramatically increase exposure to sinful images and thoughts, 2) to appeal to people's sinful desire to accumulate possessions, 3) to dull the senses of reality and what is important, 4) to encourage trust in human ability, and 5) to insulate and isolate people from each other and

from God." Because of these fears and others, the Oak Knoll Amish Mennonites suppress the influence of secular values by limiting the technology entering their community. Technology and its implementation have been an ongoing topic of discussion in the church. When a difference of opinion in implementing new technology occurs, a division in the church usually develops. After much consideration, a new church is formed. In the last two years, a group of people left the Oak Knoll church and established a new church that allows competition. Such church succession may occur because of differing values, personality conflicts, or arguments over how to achieve certain values. The Oak Knoll Amish Mennonites see competition as furthering individual rather than community needs.

Competition is seen as an issue because increasing productivity is necessary for economic survival, but balance must be constantly maintained between the community and the individual's needs. The controversy over competition is the result of some members wanting to see, attend, and participate in competitive sports. The split in the church is "deeper than just being able to attend or participate in large sports, competitive sports" (Interview, August 1, 1995). For the Oak Knoll Amish Mennonites, modern competitive sports from baseball to soccer consists of a plethora of technological advances. What is technological is neither an object nor a procedure but a way of thinking both ideally and practically. Technological limitations are a manifestation of choices that help to exclude the secular world and its conflicting values. Competition, thought of as a Western value, is deemphasized by the Oak Knoll Amish Mennonites. Paul remarks that the belief in noncompetitiveness "is because of Christian principles" (Interview, July 16, 1995). For the Oak Knoll Amish Mennonite community, competition promotes the notion of individuality. This concept of individuality is seen by the Oak Knoll Amish Mennonites as contrary to their ideal of community. By deemphasizing competition

and rejecting it as a non-Christian value, the Oak Knoll Amish Mennonites believe they maintain more of a sense of community.

Apprenticeships and Technology

One tie that strongly connects the schools and businesses is apprenticeships. Realistically speaking, these businesses sustain the community. Many teenage boys work in community businesses (see Figures 5.2, 5.3, and 5.4). In some instances, young men and women work together in their apprenticeships (see Figure 5.5). Many young teenage girls apprentice with their mothers or other female members of their families in the community (see Figure 5.6) The apprenticeship model provides a real life experience in preparing the student for the work force. Use of this model is extremely important financially, both immediately and long term, to the community.

Traditional Thinking

Paul tells a story of an Amish farmer and his method used to teach many young apprentices:

> A very good friend of mine. He is not living anymore. He put together the first hay baler with an automatic tie on it, with a knot on it. The knot was not his idea. That came off a McCormick binder. The baler was not his idea. They have been baling hay for a long time. But he put the two together.

Although the Oak Knoll Amish Mennonites practice a kind of trial and error that they value, they do not connect the process to science. Furthermore, secular scientists may themselves see no connection between formal experimentation and the Oak Knoll Amish Mennonites' trial-and-error development.

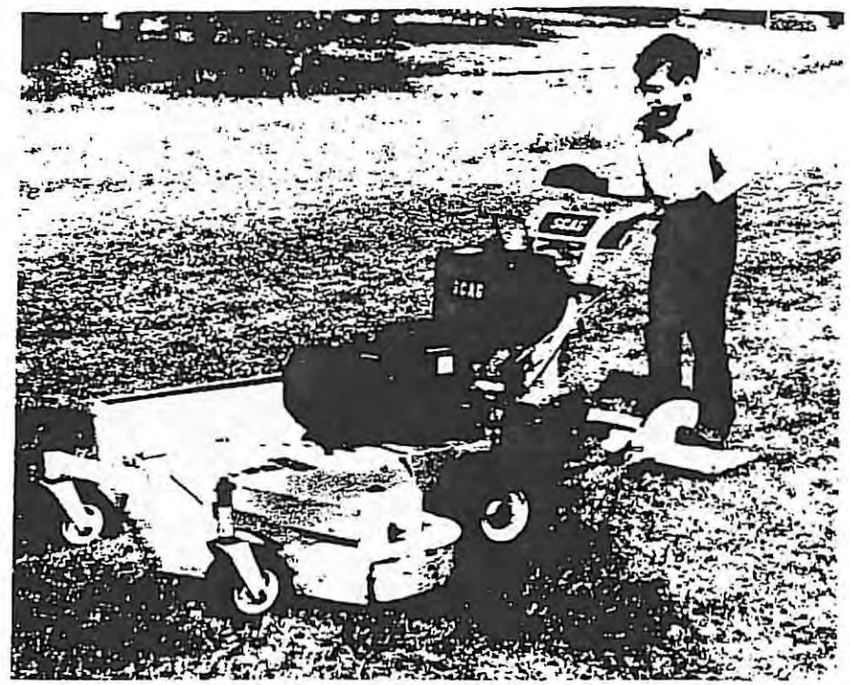

Figure 5.2. Youngsters in the community learn early how to manipulate tools. This young boy is learning through an apprenticeship how to operate this machine.

Figure 5.3. A young boy is shown how to hammer correctly by his father.

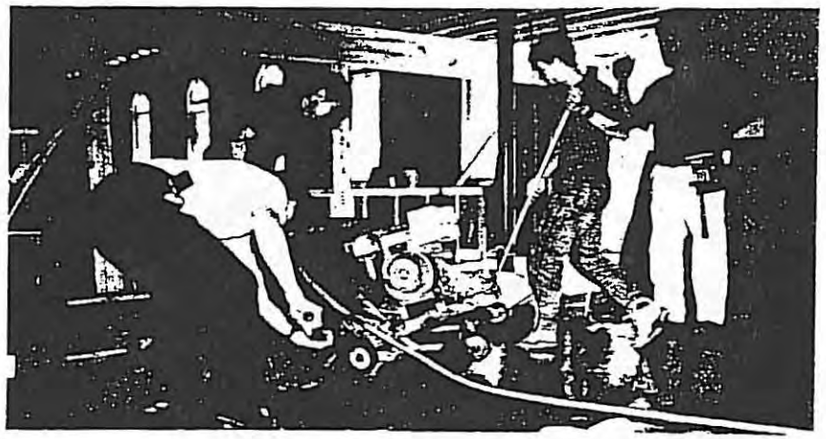

Figure 5.4. A teenage boy is apprenticed by three adults. His job after school prepares him for a job later on.

Figure 5.5. Young males and females are seen learning gardening skills. They are planting strawberries for May harvesting.

Figure 5.6. The young females also learn trades. Here they are seen canning apple sauce.

Paul says,

> They said, "You can't do that [trial-and-error development]. You need to have an engineer draw it out; you have to have someone do all kinds of tests on the different metal structures and things like this we have. You have to do all those things and test all that out before you can build it." So he was put out to pasture. But trial and error was not considered [as] advanced as a person that could draw it out and look into a couple of manuals and say that this will stand it and this will take this much stress (Interview, July 16, 1995).

The Oak Knoll Amish Mennonites are well known for taking technology and adapting it with new and innovative ideas that allow their jobs and businesses to be enhanced and made easier. He continues,

> Fifteen, twenty years ago, he was bought out by New Holland Equipment, and then Sperry-Rand bought out New Holland Equipment. Here...the grandfather of the entire business is asked to leave the shop, because he does things by trial and error.

Paul expresses concern that secular businesses have engineers design the product, draw the product, and perform the tests on the metal structures. Paul is aware that not using secular approaches to technological development disadvantages the Oak Knoll Amish Mennonites. So, a concession is made to introduce enough technology, like computers, to compete with similar secular businesses, but limiting the computers to word processing, spreadsheets, and CAD (Computer Aided Design). Using the apprenticeship model further assures the community that the students remain in the community. The students see the idea of trial and error being modeled during their apprenticeships.

Emergent Thinking

This choice of using high technology, for the moment, is found predominately in the businesses. These businesses rely on this new technology to stay competitive. Selecting workers trained by the apprenticeship approach means that this apprenticeship approach may be perpetuated in the next generation of Oak Knoll Amish Mennonites.

Computer. Even though computer technology has been only recently introduced into the school, most of the businesses rely on computing (see Figure 5.7) (Interview, August 1, 1995). Paul sees the use of computers as integral to the practical progress of the community. In discussing the need for "young Mennonites" to use computers, he recognizes the inevitability of new technology in their community. He readily accepts thoughts of new technology in Amish Mennonite businesses. Especially for the young women who apprentice in data processing positions, the use of computer is seen as integral to their job.

Paul reiterates, "We use technology when we can control it, not it controlling us" (Interview, April 15, 1994). Paul emphasizes that the Oak Knoll Amish Mennonites must have technology that can be managed. Management allows control over technology. Coupled with this control are practical applications such as are found in areas like biotechnology.

Biotechnology. Biotechnology has allowed the Oak Knoll Amish Mennonites to produce greater yields from crops and livestock. For example, the Mennonites select a hybrid corn such as Merit or Silver Queen to grow and sell to the larger community. The owners have for years recorded the pedigree of the dairy cattle to document the efficiency of milk production, but today they also use artificial insemination of dairy and beef cows as a direct application of biotechnology. By studying the community and the way technology is implemented, a more complete

Figure 5.7. Computer technology is used mostly in businesses.

picture of the Oak Knoll Amish Mennonites, their businesses, and the selling of their products appears. Paul sees technology as important first when it is applied to the economic practicality of chemical and genetic improvements. The notion of using genetic improvements conflicts with core beliefs about creationist theory. To legitimize their belief in creationist theory while applying artificial selection--developed from evolutionary theory--the Oak Knoll Amish Mennonites compartmentalize. Compartmentalization is one way people cope with inconsistencies in their thinking. This is a way of thinking that separates into distinct categories otherwise conflicting values and beliefs.

Summary

The Oak Knoll Amish Mennonites, perhaps contrary to what most people believe, do adjust and adapt to the needs of their community within its environment. Their approach reflects both an ideological and a practical view of the world. The practical view is tied directly into the businesses and how to make money, whereas the ideological view is directly linked to the religious beliefs of the people. The church embodies the religious values and beliefs. Members of the congregation are most reluctant to introduce any new change in this institution. The Amish Mennonites consider themselves least flexible in their religion compared to the rest of their life. Further, technology that may once have been viewed as contrary to religious values and beliefs can come to be understood differently. The Oak Knoll Amish Mennonites live a life balancing the worlds of the idealistic and the practical (see Figures 5.8, 5.9, 5.10, and 5.11). For in their world of idealism, the Oak Knoll Amish Mennonites strive for what they consider theoretically the best community possible in the eyes of their God. But the practical side of the everyday Oak Knoll Amish Mennonite life continues to create conflict.

Figure 5.8 Skilled labor and the use of technology associated with it is essential for economic survival in this community.

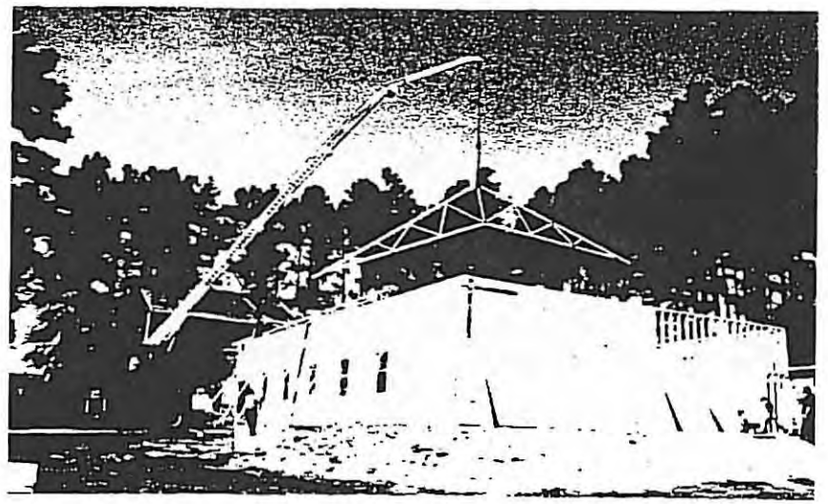

Figure 5.9. A modernized form of barn raising is seen here. The Amish Mennonites adapt to the technologies as they see fit.

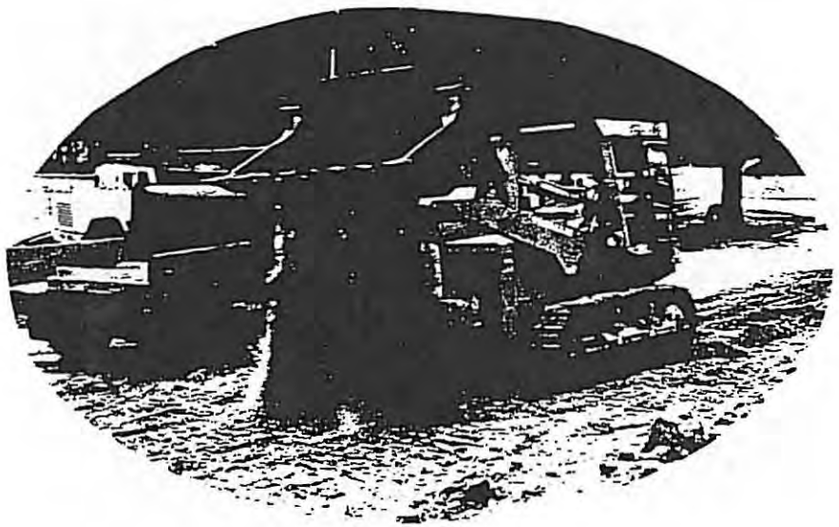

Figure 5.10. Construction is one of the main businesses for the Amish Mennonites. A worker is seen operating a bulldozer.

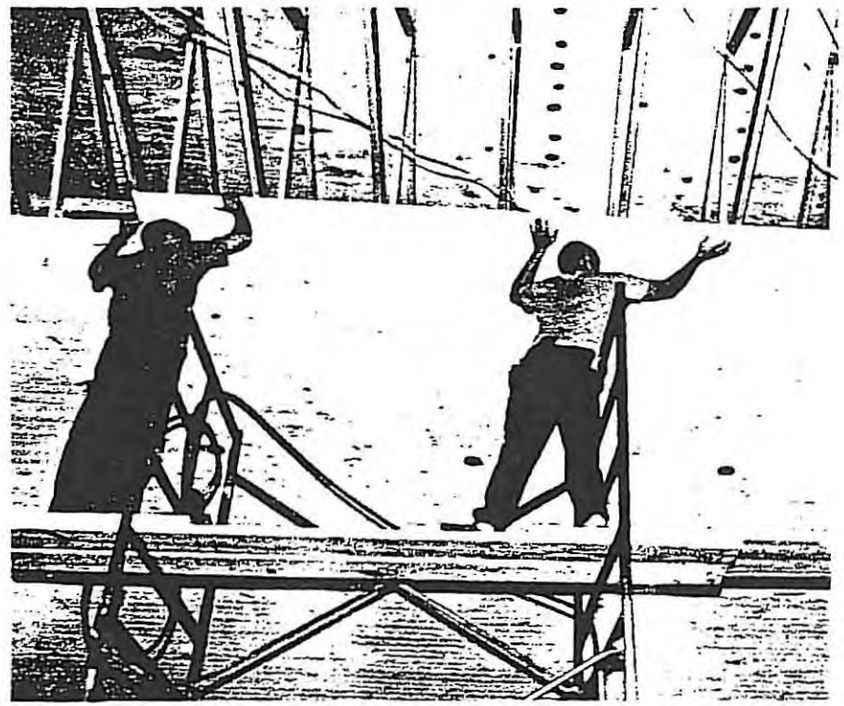

Figure 5.11. Amish Mennonites are well known for the quality of their craftsmanship.

CHAPTER VI

THE COMMUNITY

The Oak Knoll community consists of a church, a school, 16 businesses, and homes for 50 families. The central social organization from which the community radiates is the church, as previously mentioned. From a distance, the Oak Knoll community looks like many other rural communities. The exterior of the church appears as any traditional brick church. In the front are some perennial shrubs, to the left and to the back, loblolly pines. To the right, a baseball field separates the church from the school. Scattered throughout the community are family farms and homes. A typical farm consists of well-managed pastures and croplands used for grazing, planting crops, or raising hay. Many of the pastures have springs or ponds for the livestock. After being baled, much of the hay is stored in freshly painted and well-kept barns. Farm machinery is housed in barns or other buildings. The Mennonite homes in this area of the United States are usually constructed of brick or wood. They are Mennonite made, solidly constructed, and moderate to large in size. Flowers abound, surrounding the main home, the gardens, and the exterior buildings. Almost every home has a well-tilled vegetable garden. On closer examination of this community, however, differences with surrounding rural areas become evident. Differences include the Mennonites' unique dress and the lack of radios and televisions in the homes. The homes are where many Mennonite women display their craft talents, such as homemade quilts, window dressings, and decorative pillows. These homes are neat, tidy, clean, and cheerful. Fire, rescue, and police services are all located close to the boundary of this community. Rescue and

police facilities are provided through the neighboring town, less than ten miles away. The volunteer fire department is located about two miles from the community school.

In this chapter, I discuss the interrelationships, simple and complex, among the major components--church, school, home, and business--comprising this small religious community and how these components connect to science and technology. Topics in this chapter include values and beliefs, the relationship of values and beliefs to technology, differential distribution of technology in the community, and written, oral, and modeling control of scientific views and technologies adopted by the community. I finish with a summary of the family and its life cycle.

Values and Beliefs

Day-to-day existence for Oak Knoll Amish Mennonite community members consists of a value and belief system that constructs for them standards by which to live. This value and belief system focuses on religious freedom and belief in a supreme being, uniformity of community, teaching by using oral histories, civic participation, tilling the soil, worshipping in the home as well as the church, wearing appropriate dress, and selection of leaders. These values embrace community spirit (Document, November 19, 1994). Other values and beliefs that fashion Amish Mennonite lifestyle include rejection of worldly fashions; shunning; control of scientific views and technologies that enter the community; discipline in the church; humility and holiness; fundamentalist lifestyle; conventional Christian marriage; rejection of military service; rejection of oaths; rejection of litigation in courts; and submission of wife and child to the husband and father (Document, November 19, 1994). From this list, many values and beliefs of the Oak Knoll Amish Mennonites are discussed.

The Relationship of Values and Beliefs to Technology

The Oak Knoll Amish Mennonite members see a strong link between allowing a new technology into their community and having to alter their set of values. By attempting to control new thoughts or new technologies, the Mennonite elders strive to filter out secular values, which they perceive as an endangerment to perpetuating their community. Specifically, the subset of values from the preceding list that directly or indirectly influences technology include uniformity of community, discipline in the church, subservience of wives to husbands, and submission of wife and children. The introduction of new technologies may influence these values and become associated with a shift in thought and less control, contributing to what the Oak Knoll members consider a negative change in the community. By controlling the technology, they decrease the chance that their values may have to be altered. This particularly applies to those aspects of science and technology that are seen as laden with secular values, such as computers with access to the internet, television, and radio in the school. However, a discrepancy among the distribution of technologies in the church, school, home, and businesses is evident. Next I discuss this anomaly and explain why it occurs in this Amish Mennonite community.

Differential Distribution of Technology in the Community

Anomalies such as the differential distribution of technology across the Oak Knoll Amish Mennonite community raise questions about the relationship between ideology and behavior. How do these Amish Mennonites accept technology in one setting but prohibit it in another? This particular anomaly dealing with technology may be explained by cognitive dissonance (Festinger, 1957). Cognitive dissonance usually is externally induced. Pressure is put upon the individual to conform to group standards, creating a dissonance and conflict between the individual and the individual's beliefs and perceptions. Conflict usually arises with the demands of peers. The individual can reduce this dissonance and conflict either by

disassociating himself or herself from the group or by selectively ignoring those perceptions or beliefs that perpetuate the dissonance (Festinger, 1957). Cognitive dissonance explains social situations and how to resolve differences (J. Preissle, personal communication, February 17, 1998). Compartmentalization is one way individuals manage cognitive dissonance. Compartmentalization refers to the notion of sectioning or partitioning off parts of individual's lives to legitimize decisions made (Festinger, 1957). Depending on the situation, people act and react differently. The notion of cognitive dissonance, conflict reduction, and compartmentalization are used to explain situations about science and technology encountered in the Oak Knoll Amish Mennonite community.

Distribution of Technologies in the Church

The church is the core of the community. The community leaders believe it should be the place with the least amount of technology and the least contact with the outside world. Job, a member of the community, says the reason so little technology is found in the church is that "God is worshipped through being." He refers to Acts 17:24-25:

> God that made the world and all things therein, seeing that he is Lord of heaven and earth, dwelleth not in temples made with hands; neither is worshipped with men's hands, as though he needed any thing seeing he giveth to all life, and breath, and all things.

Members see no need for pianos or organs, which are viewed as distractions. Job says the Amish Mennonites believe the spiritual and physical body is the purest form of being. Musical technology represents an artificial manifestation of being. However, Job does say, "If there was a technology which would enhance our church service, we would use it." Thus, the addition of a sound system is justified and compartmentalized by the elders: they define the sound system as a different category of technology than a musical instrument. The notion of compart-

mentalization (Festinger, 1957) gives justification to the elders for allowing this new technology in the church. They see this addition as no threat to their community. In no way does it interfere with the values that the Oak Knoll Amish Mennonite community is trying to perpetuate.

However, technologies that carry the voices of outsiders are excluded from the church. These technologies are perceived by the elders to tempt community members to leave the Oak Knoll Amish Mennonite community. Excluded are television and radio. Computers may be included unless they are linked to the World Wide Web. I think that the Oak Knoll Amish Mennonites believe temptation lurks out on the web for the Oak Knoll Amish Mennonite children to find. This temptation may be sufficient to draw them away from the community. Further, they believe that the balance that maintains this community is very fragile. The elders fear upsetting the balance when they contemplate adding any technology laden with secular values. The world-connecting technologies might be contrasted with the sound system that transmits the church service over the phone to invalid members not only poses no threat, but also fosters the church's goals. Again, technological addition to the church service would be allowed only if it was seen to somehow enhance the physical or spiritual body. Therefore, the church elders limit themselves to a speaker system, a telephone, electricity, and air conditioning. With the addition of the speaker system to the church, no conflict arose among members. The majority of the church saw no conflict with their values by adding this technology. Cognitive dissonance is not seen here because conflict does not arise in this matter. In this situation, the members are able to relate their values and beliefs to their choice. The social situation generated by the addition of a sound system was not disturbed.

Distribution of Technologies in the School

The school is such a reflection of the church and what it represents that technologies are kept to a minimum as discussed in Chapter IV. Job considers the school a "training center for future members." The school has a few more items of technology than the church; in addition to a telephone, air conditioning, and electricity, it has a duplicating machine and a reading machine just updated with two computers used exclusively for word processing. Job says the school has two purposes: (1) basic education and (2) Christian development. Therefore, the Oak Knoll Amish Mennonite education takes on a holistic training of mind and body. Here is where cognitive dissonance in the community begins to emerge. A debate about the teaching of word processing with computers in the school has lasted ten years. The issue of allowing a new technology into the community is complex. The elders make the decision pending a final approval by a majority of the church congregation. To date, the congregation has voted with the elders. The voting of the congregation is usually a formality. However, the elders of the church wear many hats. They serve on the school board and are <u>all</u> business people. Therefore, they are trying to balance the traditional and the innovative for what they see as best for their community.

Distribution of Technologies in the Family

Because people in Amish Mennonite families have so much contact with the outside world, more technologies are found in the homes than in the church or school. For example, from a distance Henry's home appears to be a modern home equipped with up-to-date appliances. However, this home lacks a television and radio. Henry's home is not uncommon in the Oak Knoll Amish Mennonite community. He is a second-generation Mennonite to this area. Henry has much technology in his wrought-iron business. Also, Henry is a photographer who uses contemporary equipment.

Henry owns a white 1989 Ford truck that he uses at home, at work, and on the farm. All forms of transportation are used by the Oak Knoll Mennonites. Modes of transportation for public and private business are necessary. Limited are the choice of cars. Colors are typically those considered neutral by the Oak Knoll Mennonite community. However, makes of cars can range from the cheapest American-made cars owned by young Mennonite teenagers, to those like the Mercedes-Benz, owned by the restaurant owners.

This discrepancy in color versus make is masked by compartmentalization. The Oak Knoll Amish Mennonites believe flamboyancy would be recognized more easily at first glance by the color of the car. A closer examination by outsiders, or the English, as I noted outsiders are called in Chapter I, would detect and uncover a more fanciful lifestyle.

Henry's wife spends many hours sewing for herself, her family, her friends, and her patrons. The sewing machine becomes an instrument or tool to clothe and nurture her family. It provides a safe outlet for creativity that coincides with her values and beliefs. Economically, it provides her with some income. But also it perpetuates the Oak Knoll Amish Mennonite community order by keeping her in the home, in her place.

Cognitive dissonance in this Amish Mennonite community is particularly evident in the family. Contact with secular families and more liberal Mennonite families has created conflicts about adding technology to the homes. However, this conflict, as opposed to what occurs in the church and school, varies from family to family. For example, one family may choose to have a dishwasher after much consideration, whereas the neighboring house may have not a dishwasher but a trash compactor. Social contact with other families exposes the Oak Knoll Amish Mennonite family to new ideas and new technologies. These exposures create more external peer pressure and produce more internal conflict for individuals.

Even though the elders try to limit competition in the community, it still exists. One typical way of expressing competition is through participation in organized sports. If a child participates in an organized sport, then the entire family leaves the church. The family breaks away and finds a new church whose values and belief system allows such participation. In twenty-five years, approximately twenty-four families have left the Oak Knoll Amish Church (Interview, October 31, 1998). Breaking away reduces conflict in the family where choices about the raising of children are made and, in turn, reduces the stress level that family members experience. Dissention and conflict is part of their lives. When dissention becomes too great, the people schism. The Oak Knoll Amish Mennonite community as well as other Amish Mennonite communities know this dissent is coming. Historically, this has happened. The church members recognize this dissent as they acknowledge their community is moving into the information age. The schism is the physical reflection of the mental activity of compartmentalization.

Distribution of Technologies in the Businesses

Technology in business is where the greatest discrepancy in technology is seen compared to the church, school, and home. The Oak Knoll Amish Mennonite businesses are necessary for economic survival of the family and community. Oak Knoll Amish Mennonites must sell their products and services to people outside their community, and in doing so they must also make a profit. They seek a balance between their belief in a set of values and their sustainability as a community. So technologies such as facsimile (FAX) machines, answering machines, and computers are seen as necessary and useful items to expedite their work. The interface between Oak Knoll Amish Mennonites and the secular world is business. Thus, the businesses must be able to communicate effectively with the secular world. To accomplish this, the Oak Knoll Amish Mennonites have to adjust some of their beliefs. However, even in the businesses, television and radio are excluded, again

because of the exposure they would bring to the outside world with its different set of values.

Merle's cabinet shop has technology comparable to non-Amish Mennonite shops. These include spray glue machines, compression machines, post formers, radial arm saws, table saws, band saws, and fork lifts. A large laser beam, for specific tasks, has been added to the table saw to increase its accuracy. The post former rounds the front edges of counter tops. The front office and showroom has Christian music playing on CD's. This playing of music signals customers this is a Christian shop. It shows the customer who the Amish Mennonite are and reaffirms by modeling what they believe.

Paul's welding shop has a FAX machine, a copier, fork lifts, metal cutting shears, form breakers, iron workers, plasma cutters, band saws, hydraulic pipe and tubing benders, and an air compressor. Again, each technological machine is specific to tasks. For example, Paul uses the plasma unit to cut aluminum and stainless steel, which cannot be cut with the more conventional oxygen-acetylene torches.

Each decision about using technology is careful and deliberate. For example, Paul, my key informant, delayed purchasing a FAX machine, answering machine, copier, and updated machinery until he built a new office and shop. As for the businesses, the choice of technologies is individually based. However, these businesses recognize that the use of television, the World Wide Web, and the radio lie outside of the limits. Each owner is given the leeway to make distinct choices. However, only in the businesses does this apply. Still, Paul has no computers. Cognitive dissonance reaches an apex here in the area of business. A conflict between values found in the church and school and values found in business practices creates a very stressful situation for many. Decisions to introduce a new technology must be carefully weighed, legitimizing each technology for adoption in

the workplace. These same technologies may not be comparably acceptable for use in the church, school, or family.

In summary, the Oak Knoll Amish Mennonites wait as long as possible to introduce new technologies into their businesses. In contrast, the neighboring Amish Mennonite community church, Silent Pines, located fifteen miles away, is much more liberal in introducing new equipment and technology. The people of Silent Pines have more business and social interactions with the secular community. For example, members of this community are allowed to listen to the radio. The more contact with the secular world, the faster the technology is adopted by the community.

Community Control of Scientific Views and Technologies

Control of how members consider scientific views and technologies is transmitted orally, in written form, and through modeling. The Oak Knoll Amish Mennonites verbalize their stories and histories. Modeling is evident in choices like their mode of dress. Methods of written control include small, evangelical brochures referred to as "tracts" and monthly newsletters.

Processes of Control

Writing talking, and modeling are common means of social control across situations and contexts. Each type of control is illustrated by examples, showing how the process of control is found is every aspect of these Amish Mennonites lives.

Written Social Control

Customers who enter Paul's business find a stand containing tracts to browse or take to read; these are small brochures on topics such as marriage and divorce, faith, and standards of dress. Tracts and newsletters are written forms of social control intended to evangelize. Each of these tracts provides a scripture, lesson, or explanation of the Amish Mennonites' beliefs. Monthly newsletters, written in the

community or by the national Amish Mennonite center in Ohio, are distributed to Oak Knoll Amish Mennonite community members. Ohio is the central location for the distribution of materials throughout North America, Central America, and South America. Perpetuating the values and beliefs of Amish Mennonites depends on using many techniques such as oral and written forms of social control. In the following sections, examples of oral and written forms of social control are discussed. The use of modeling is examined later.

Evolution. One of the Amish Mennonite tracts is entitled, "Creation or Evolution: Which is True?" A discussion from the tract about evolution and creationism says,

> Two generations of Americans have been brainwashed into believing that evolution is fact, that over a billion years, atoms, flying in an infinite variety of ways, accidentally fell into the present pattern without any intelligent, supernatural direction.

A fundamental Amish Mennonite belief is that their God is the exclusive creative force. The Amish Mennonites see this God as having a plan of action for the human species. They believe that events happen purposefully, especially the creation of the earth. More important is that Amish Mennonites charge many people in the U.S. with brainwashing individuals into believing evolution is fact. No matter how evolution is introduced into the public school curriculum, the Amish Mennonites perceive it as a manipulative tool of the secular world to force the belief in evolutionary thinking on everyone. The tract continues to say,

> It took a society raised on television fantasies and science fiction to become zealots for such a belief system. The paranormal is replacing the proven, established principles of science. Theories of origins, such as punctuated equilibrium set forth by respected scientists of our day, would have destroyed those scientists' credibility a few years ago. Now these imaginations are heralded to the public by the media, which looks for any mechanism possible to substantiate its evolutionary faith.

The Amish Mennonites see evolutionary theory as a type of faith. They discuss punctuated equilibrium as a theory of origin. However, to biological scientists punctuated theory is an evolutionary mechanism. The Amish Mennonites see scientists as putting their trust in discovering more about the paranormal. Their perception of the public schools is that science taught in public schools is not scientific but a paranormal science influenced, for example, by television. The Amish Mennonites compare the secular society raised on television and scientific literature to religion and believe this pseudo-religious media has replaced established principles of science.

However, a more severe conflict arises between this religion based on faith and more concretely demonstrable principles of science such as the laws of physics and the axioms of genetics. Compartmentalization is exhibited among their religion, their application of genetics, and their rejection of evolutionary theory. In this instance the idea of conflict does not surface. Instead, what surfaces is this notion of compartmentalization. The application of genetics as discussed in Chapter IV is seen as a separate entity not associated at all with evolutionary theory. The Oak Knoll Amish Mennonites have no formal training in evolutionary theory. Therefore, they lack the preparation to differentiate between such ideas as punctuated equilibrium as a theory of origin or evolutionary mechanism. Oak Knoll Amish Mennonites can read the literature on evolutionary theory, but compartmentalize what they read to align with their values and beliefs. What they do not understand they consider evil. This comes from the Hebrew word *Ra* that is translated as "evil" in the King James version of the Bible. *Ra* means worthlessness or uselessness, and by extension it came to mean bad, ugly, sad, or evil (Parkins, 1985). For the Oak Knoll Amish Mennonite, evolutionary theory is considered useless and worthless because their

explanation of creationism justifies the origin of life. Again then useless and worthless are associated with evil.

Water. In one monthly Amish Mennonite community newsletter, the topic of the physical need for water is used as an analogy for spiritual needs. Samuel, a writer for the Amish Mennonite Newsletter, writes,

> Did you know that water covers more than 70 percent of the earth's surface (326 million cubic miles; each cubic mile contains over a million gallons of water)? However, only three percent of the earth's water is fresh. Three-fourths of the fresh is frozen in icecaps and glaciers. A large portion of the remaining one-fourth is trapped underground, leaving only about 36 percent of all the earth's water in drinkable form.

First, Samuel presents factual information about water. However, a cubic mile of water actually contains over one trillion gallons of water. He introduces the discussion by conveying information hard to dispute. Sam then begins to make the connection between the factual information and the human physical need for water:

> In our homes, we use far more water than the amount we need to simply stay alive. We require water for cleaning, cooking, bathing, and carrying away waste. On the average, every American uses more than 100 gallons of water in the home. Millions of homes in Asia, Africa, and South America have no running water. The people must haul water up by hand from the village well, or carry it in jars from pools or rivers far from their homes.

Samuel then ties the narrative together by comparing a spiritual need for Christ with the physical need for water.

> Water is figurative of Christ. We read in John 4 about the woman of Samaria that came to draw water from Jacob's well. Her response to Jesus in verse 15 indicates that she knew of the hardships of hauling water by hand. When Jesus said to the woman, "Whosoever drinketh of the water that I shall give him should never thirst," He was offering Himself, the Living Water. This water supply will never run dry and is still available to us today. Are you drinking of the Living Water? (Document, June 10, 1997)

Water is a common topic for discussion among the Amish Mennonites or any fundamentalist religious group. Because water is essential for survival, its symbolic importance is easily understood. Factual information about natural elements such as water can be readily obtained from encyclopedias and dictionaries. From this basic information accessible to the Amish Mennonites, they can integrate what they view as scientific knowledge--information about natural phenomena--with quotes from the Bible. The church thus perpetuates the idea of science and religion as one. Contemplating examples such as water brings the idea of science into their everyday lives and their religion.

Second Law of Thermodynamics. Another example showing the control of scientific views in the Oak Knoll Amish Mennonite community is illustrated with the second law of thermodynamics, discussed in one of the tracts:

> As for the community's position on evolutionary theory, the second law of thermodynamics is just one basic law that evolution violates. This law states that the energy/matter component of the universe is in the process of entropy, or moving to a less usable form. Nature is running down, things wear out, and resources are expended. This scientific fact is stated in the Bible. Hebrews 1:10-12a.

From a scientific point of view, the second law of thermodynamics explains the tendency toward chaos or randomness. One interpretation of the concept of entropy involves the spontaneity of processes. Spontaneity always requires a change from a higher to a lower energy state (Weast & Lide, 1990). For example, most academic scholars believe life began because the energy present from the sun and other sources be came chemically available. However, the Amish Mennonites cite the

second law of thermodynamics when it supports their beliefs but do not consider this complementary idea of what may develop when energy does become available.

The New Testament Hebrews 1:12 states, "And as a vesture shalt thou fold them up, and they shall be changed: but thou art the same, and thy [Jesus Christ] years shall not fail." Hebrews 1:12 refers to a prior passage in the Old Testament Book of Psalms 102:27 that states, "But thou art the same, and thy [Jesus Christ] years shall have no end," which can be interpreted as meaning that Christ does not or did not ever change (R. Ruble, personal communication, May 4, 1998). The Amish Mennonite interpretation is that if the second law of thermodynamics means that everything in the universe goes to a chaotic state, then the law cannot be true. The interpretation is that Jesus Christ does not change or become more chaotic in physical form. The Amish Mennonites interpret disorder or chaos as "moving to a less usable form." Therefore, they see evolution as contrary to the second law of thermodynamics. This argument is frequently used by Christian fundamentalists to support the case against evolution of things evolving over time.

Oral Social Control

Community members express in conversations ideas and principles they believe control their community. Whenever a conversation occurs with a member of the community, the member orally acknowledges conformity on the decisions about curriculum in the school. For example Oak Knoll Amish Mennonites see general mathematics as necessary in the businesses, for billing customers, paying vendors, and keeping records. On the other hand, algebra is considered frivolous.

Algebra. Paul. in an interview, speaks about the practical side of formal schooling:

> Somehow get this educational stuff that we have into the minds of children in a way that has some application. That's why we have not required all of our children to take algebra. For practical reasons some of these things are never needed. If they could take something else that could help them, an elective, we would excuse them from taking algebra (Interview, July 7, 1995).

For the Oak Knoll Amish Mennonites formal schooling has specific purposes. The purposes are two-fold: to provide the students with the background needed for the workforce and to reinforce their religion. Throughout formal schooling general math and reading are emphasized. The Oak Knoll Amish Mennonites believe these two subjects best prepare students for life. Algebra, for this community, is considered a luxury. Time for algebra, Paul suggests, "could better be used for something else that could help them."

The question can be posed whether they know how to apply algebra to the business sector of the community. This situation is not unique to the Oak Knoll Amish Mennonite community. Secular public school students must be educated as well on how to apply algebra to solve real-world situations. However, for many Oak Knoll Amish Mennonite students, algebra is enjoyable. Christie, a high school student, says, "I like algebra. I would use it in my job when I finish high school. You could use algebra. You can even skip steps. Use the basic principles." Samuel, a Mennonite teenager who has graduated, wants to see more of a connection between his work and the algebra he learned in school. He says he would use advanced math, more specifically geometry, if it would make his work easier to complete. The younger generation of Mennonites see a need for the application of mathematics such as algebra and geometry to the workplace. Because computers have only recently been introduced in the school, all general mathematics have been done by hand or on a calculator. Each child brings a calculator to school. Calculators are also widely used in the Mennonite business field. The Amish Mennonites consider general mathematics concrete, real, and practical. However, the older Amish Mennonite generation perceives algebra as abstract and removed from the real world. As far as the Oak Knoll teachers are concerned, their mathematics

training is what they learned in their elementary and high school math classes. Therefore, the amount of algebra learned is very limited.

Paul realizes that technological change in the workforce requires male and female students' proficiency in using computers. He continues, "If I talk to people who want it done this way, I have to automate my work if I'm to remain competitive. Necessity almost brings it upon me." Paul has the insight to see change as imperative for the businesses. The pressure to automate is evident. Paul admits that keeping a competitive edge requires change. For Paul, the conflict is resolved by selecting the economic priority. Cognitive dissonance is extreme in this instance. Parental pressure from inside the community to computerize has been high. John observes that the parents are the ones who have pushed for the implementation of computers in the school. They see that the Mennonites must enter the information age.

Computers in the School. As of Spring 1998, two new IBM computers without access to the Internet or electronic mail had been added to the library of the school. These computers will eventually replace the reading machine that has become outdated. Also, an elective computer class is to be added for the basic computer skills. Historically, as well as now, new technology is slow to be accepted. The conflict exhibited by the dilemma of adding computers took ten years to resolve. This decision was difficult to make because it will help modernize the curriculum of the school. The addition of a Miscrosoft Works computer class replaces the basic reading program. This reading program has been core of the school's curriculum, and women volunteers from the community have been in the school each day to monitor the reading program. For the first time when students complete a unit in computer programming, they are able to reinforce what they have learned by actually using the computer. Students will have the opportunity to connect the learning of subject matter taught in school to the job market.

Modeling as Social Control

Modeling is the dominant way many Amish Mennonite communities, including the Oak Knoll Amish Mennonite community, share their worldview. If a person does not model a certain lifestyle, then punishment may include the act of shunning. An indication of the Amish Mennonites' firm commitment to their values and belief system is shunning. Shunning is the act of completely avoiding an individual who has fallen out of grace with the church and goes one step beyond the expulsion mentioned earlier, with regard to competitive sports. Shunning becomes the ultimate means of social control. Individuals are required to conform to the standards set by the elders of the community. Based on I Corinthians 5:13: "Put away from among yourselves that wicked person."

One such incident occurred in this community several years ago. Anna and Merl, a couple who were not married, were discovered having sexual intercourse. Anna was sent to live with a family in Ohio. Merl was thrown out of the church and was shunned. Merl still lives in the surrounding area and continues to work in the trade to which he was apprenticed; however, he is not working with Amish Mennonites. My key informant, Paul, shares with me information about shunning:

> As regards the withdrawing from, or the shunning of, those who are expelled, we believe and confess that if anyone, whether it be through a wicked or perverse doctrine is so far fallen as to be separated from God and consequently rebuked by and expelled from the church, he must also, according to [the] doctrine of Christ and his apostles, be shunned and avoided by all the members of the church (particularly by those to whom the misdeeds are known), whether it be in eating or drinking, or other such like social matters. In short, that we are to have nothing to do with him so that we may not become defiled by intercourse with him and partakers of his sin; but that

he may be ashamed, be affected in his mind, convinced in his conscience, and thereby induced to amend his ways.

There is no room for flexibility on these religious tenets. For instance, if an Amish Mennonite male was "caught" having a television in his home, he would be shunned by the church members.

One of the most powerful avenues in which the Oak Knoll Amish Mennonite elders perpetuate control of this community is through modeling different components of their lives. The components consist of everything from modeling control in the sanctity of the church to modeling lifestyles in each stage of the life cycle.

Modeling Through Belief in a Supreme Being. One of the central beliefs of the Oak Knoll Amish Mennonites is that their God is all-powerful. Jane, a volunteer at the school, speaks of this issue,

> But uh...the Bible doesn't teach us to be subject to those who are in a position over us, and like it says, we are on the same level and yet there are times when they have to go with the consensus of the church group as a whole to make a final decision, but, uh...it's only as they [members, males, females, and children in the church] are under their [the elders'] leadership which is God and then we can feel safe in accepting their...I mean, they have to give account to God. And so as we listen to them [the elders], we can feel safe in letting them be that authoritative figure as long as they are in the right order.

Jane believes, as do other community members, that order is maintained through total trust in their God. This authority of God, passed to the people through the elders, allows the Oak Knoll Amish Mennonite members "to feel safe." This protected and safe feeling is transmitted to each young child in the community. This all-encompassing authoritative stance allows little room for questioning elders' decisions on issues about science and technology as previously discussed. No

conflict is seen here because no questions are raised in the church about issues of science.

Modeling Through the Sanctity of the Church. The Oak Knoll Amish Mennonite Church contains a main sanctuary. It has nine Sunday school rooms: five on the main floor and four in the basement. An addition to the main building is primarily used as a larger sanctuary. Inside, a vestibule leads into the old sanctuary (see Figures 6.2a and 6.2b). A larger sanctuary was added in 1995. Located on each side of the room are wooden pews that are Mennonite made. Traditionally during the service, the men sit on the right, and the women sit on the left (see Figure 6.3). The reasoning I was given for this is that children behave better with their mothers. A podium, a simple wooden cross affixed to the wall, and a few chairs make up the front of the church. Missing is an organ, piano, or any musical instruments. These are excluded because they are associated with secular technology. The walls are painted white, and the windows are white opaque so no one can see in or out. Blue carpet covers the floor. On the average, 170-180 members attend the church each Sunday, most being members of the Oak Knoll Amish Mennonite community. Financial support comes from the yearly school auction and the Sunday offerings. Over the course of a month, one Sunday's offering supports the school, one Sunday's offering supports the foreign missions, one Sunday's offering supports the general church fund, and one Sunday's offering supports the building fund. On the fifth Sunday, occurring four times a year, a love offering is taken for the ministers to help offset expenses. The activities that the church sponsors include "sister" sewing bees, fund-raisers for the school, and dinners for youth at members' homes.

These activities filter over to the school. For example, as discussed in Chapter IV, the school houses the monthly sewing bees. Women quilt by hand without the aid of a sewing machine. Sewing by hand is part of their tradition and the heritage

Figure 6.2a. Monthly sewing bees are a main social gathering for the women. The heavy quilts go to Rumania and the light quilts go to Central and South America. Some are made especially for the school auction.

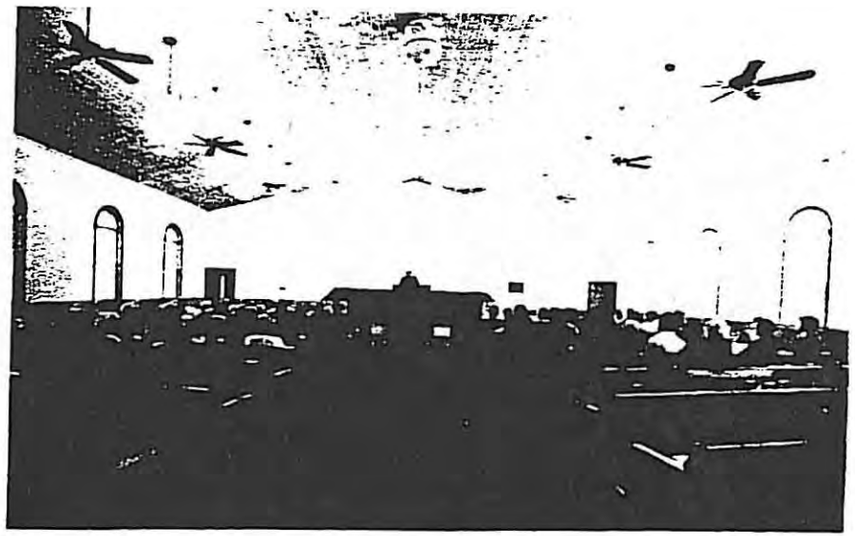

Figure 6.2b. Addition to the church is seen here. The members of the community volunteer their time and the expertise of their trades.

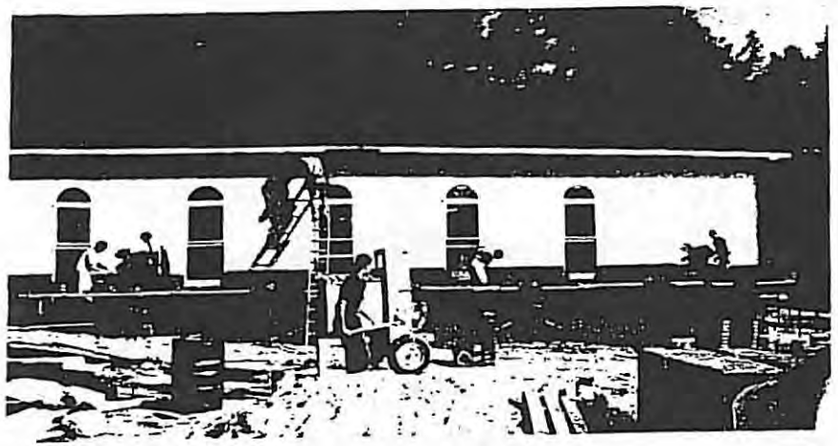

Figure 6.3. The church of the Oak Knoll community. Traditionally, the men sit on one side and the women sit on the other.

they want to maintain. The making of quilts is considered art and is symbolic of the community unit. Many of the quilts created at the quilting bee are for distribution in Central America and Rumania and the rest are for sale at the auction, as described in Chapter III. Oak Knoll Amish Mennonite homes, quilts abound. In most homes, several generations of quilts are seen at the foot of the beds--mothers', grandmothers', and so on. Patterns include the Colorado Star, Double Wedding Ring, the Lone Star, and Log Cabin (see Figure 6.2a). Newer craft of producing a dress with the aid of a sewing machine is balanced with the old ways of sewing by hand at the monthly quilting bee. Electric sewing machines have been used by the Oak Knoll Amish Mennonite women for the past generation. The generation prior to that used a treadle sewing machine. More than anything, the quilting bees tie the women to a strong tradition where the sharing of conversation perpetuates, models, and reinforces a certain way of life. This reduces conflict in using a new technology. The church acts as a hub for social organization of the community because church ideas and traditions are established. The school, family, and businesses become arms that carry out practical aspects of religious life.

Patterns of Social Control

The following are common situations, contexts, and norms where control is experienced. Each example is an everyday occurrence where social control is found.

Civic Participation

Helping other people is highly valued in the Oak Knoll Amish Mennonite community. Although Oak Knoll Amish Mennonites live outside the social mainstream, they consider themselves good neighbors. These individuals turn their efforts to volunteerism by choosing to serve as firefighters for local voluntary fire departments in the rural community and as workers for the rescue squad for the immediate area. Because fire and rescue operations are considered responses to

life-threatening events, members of the Oak Knoll Amish community can elect to volunteer for this type of service. Traditionally and presently, the Oak Knoll Amish Mennonites readily assist non-Amish Mennonite neighbors in times of disaster, fire, and illness. Many volunteers have traveled out of state or country for the Mennonite Disaster Relief Service to rebuild homes destroyed by floods, hurricanes, or tornadoes in non-Amish Mennonite communities.

The Oak Knoll Amish Mennonite community members dine at most restaurants in the community such as Pizza Hut and Ryan's. Excluded are restaurants that serve alcoholic beverages. Young Oak Knoll Amish Mennonites may visit parks or other recreational facilities. Limitations are participating in events that go against their value and belief system. Attendance at most public events and places, such as fairs, dances, and theaters, is prohibited for church members. Selective participation in civic affairs honors the value of and belief in separation from the secular world.

Their participation in outside organizations, again, is selective, informal in the sense of avocation rather than vocation, and locally oriented. Community members do not join secular service organizations, Boy or Girl Scouts of America, Little League teams, or professional and business organizations. These organizations are considered laden with secular values and, in some instances, such as Little League games, extremely competitive. Competition is considered to be an inappropriate value. The Oak Knoll Amish Mennonite community believes that competitiveness works against the idea of community spirit. They believe that the family itself provides children with many community development opportunities, so there is no need to go outside the Oak Knoll Amish Mennonite community for other experiences.

Even with these very tightly identified standards, members of the Oak Knoll community engage in social recreation among themselves. Social activities that

incorporate technologies that the Oak Knoll Amish Mennonite perceive as free of secular values are similar to recreations that children in the surrounding community enjoy: water skiing, four-wheel vehicle riding, and fishing (see Figures 6.4, 6.5, and 6.6). While engaging in activities such as these, the Oak Knoll Amish Mennonite teenagers stay within the boundaries of their own community.

Historically in this community when a schism occurs, it concerns recreation and leisure. The elders accept some variation in recreation and leisure among the community and compromise on allowing boats and four-wheel vehicles. This compromise provides their teenagers some of the freedom that secular teenagers experience. These particular activities are not seen as threatening to the community. Boats are used in fishing and water skiing. Technology needed to construct the four-wheel vehicle is produced in the outside secular world. The purchasing of these sports vehicles, which are not considered to be laden with secular values, complements Amish Mennonite values and is perceived as a technological advancement compartmentalized from secular science. To reiterate, these particular sports are seen as promoting community spirit just as does the donning of certain clothes. However, much conflict may be experienced in dealing with certain activities. The decisions to use or not use a technology varies from family to family. Whether choosing to participate in a sport or deciding to wear printed dresses that go against the guidelines of this community, the choice is personal, but is usually made as a family decision. As previously referred to in this chapter, the family acts as a core unit in the community.

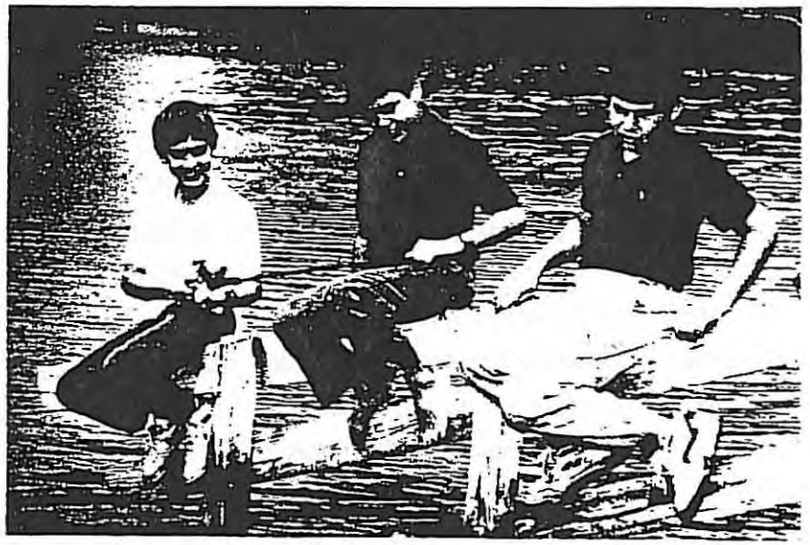

Figure 6.4. As with many youngsters, fishing is more than a sport. It is a social event.

Figure 6.5. Amish Mennonite children are seen on a four-wheel vehicle.

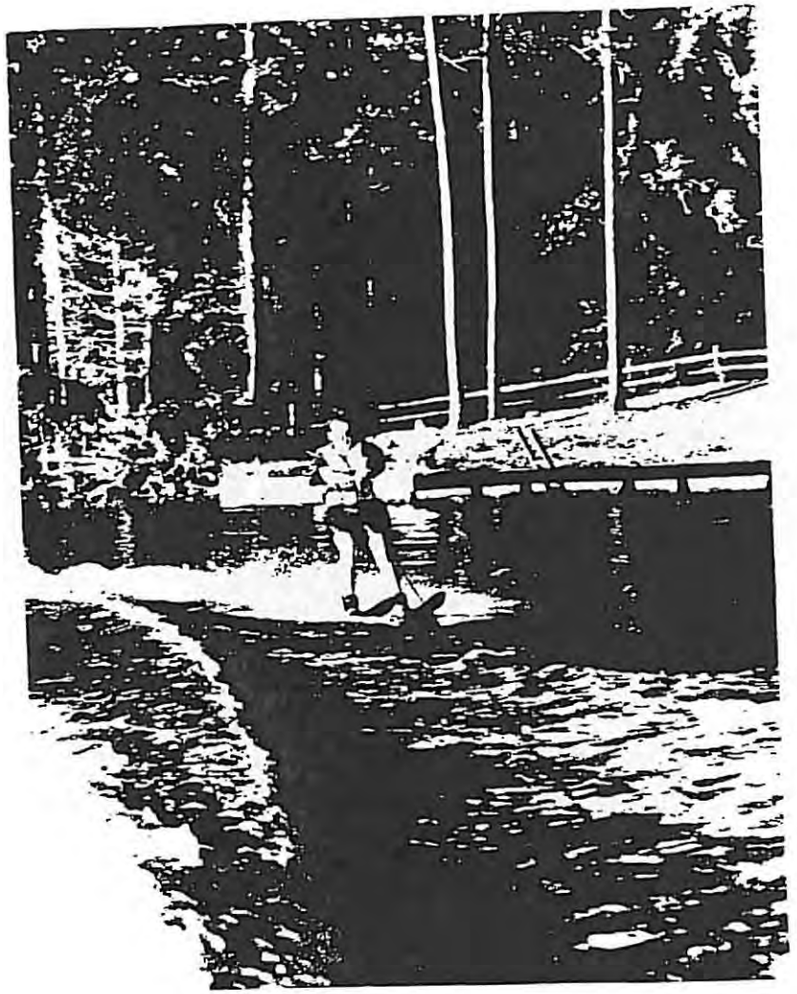

Figure 6.6. A young Amish Mennonite boy is seen enjoying water skiing.

Rejection of Worldly Fashions and Modeling of Values

The Oak Knoll Amish Mennonites' clothing is a physical symbol of their adherence to community values. They refer to scripture:

> I will therefore that men pray every where, lifting up holy hands, without wrath and doubting. In like manner also, that women adorn themselves in modest apparel, with shamefacedness and sobriety; not with braided hair, or gold, or pearls, or costly array; but (which becometh women professing) godliness with good works (I Timothy 2:8-10).

Clothing distinguishes Oak Knoll Amish Mennonites from others in the secular world. It is the first visual cue that an individual is a member of this community. Each Amish Mennonite community has a specific code of dress for males and females. The women of the Oak Knoll Amish Mennonite community must comply by wearing solid color dresses cut in a particular style. Any solid color is acceptable. The women are required to wear their uncut hair bound under a white prayer cap with a ribbon attached from one side to another in the back behind the head. Paul's wife, Ana, makes and sells them for $5.00. Young girls don the prayer caps on entering formal schooling. The men dress in neutral solid colors such as blue and black. They are required to wear suspenders with their pants because suspenders are less decorative than belts. Married men wear a beard, and unmarried men must be clean shaven. Paul says the women's custom of wearing the hair bound and covered is Biblically determined. However, the men's custom of wearing a beard when married is based only on tradition. Therefore, the Amish Mennonites want to express and reaffirm their strong beliefs to the secular world. Because they model what they believe through example, clothing becomes significant. This simplified clothing is the first thing outsiders notice. The detailed type of dress easily identifies individuals with a particular Mennonite community.

This dress is a physical acknowledgment to others that Amish Mennonites subscribe to a community dissociated from the world and its technologies. The clothes are a symbolic manifestation of the simple technology used by this community–just as, for example, previously discussed, tractors without air conditioning are chosen for their simplicity. The same is true of the dress. The women's dresses are solid and simple styled, the prayer cap is plain and white, and the men are dressed in solid shirts and pants. They are modeling their lifestyle for the rest of the world to see. In other words, simple dress equals simple living equals simple technology. No conflict is tolerated on dress among this community. People who have broken the dress code must leave the Oak Knoll Amish Mennonite church and school.

Uniformity of Community and Control of Values and Beliefs

The children's socialization in the science classroom as well as the entire school provides an environment for children that reflects the values of their parents: life is stable and predictable, secure, certain, and orderly. As one parent says,

> The friendships that they make there [in school], are with those who also have the same set of values. If you send your children to public school today, you have a different set of values from all different kinds of people that are different from their own.

The culture of any school is a combination of the modeling of values, norms, beliefs, and expectations of all the students, teachers, parents, community members, and others. For an Oak Knoll Amish Mennonite raised in a homogeneous environment, the values and beliefs found in a public school can cause unpredictability, insecurity, and uncertain experiences. Even the stories told by the older community members contribute to this continuation of Amish Mennonite beliefs. Again, this social control, perpetuated by the school, is manifested in the uniformity of the community. In other words, their experiences outside the

classroom, in their homogeneous community, instill a continuity, reinforced in the science classroom and the school at large.

Choice of Leadership and Its Relationship to Order

Leadership is restricted to male members of the community. This choice of men as leaders occurs in all parts of the Oak Knoll Amish Mennonite community.

Ministers in the Church. When a minister retires or moves, the position must be filled. The selection of ministers is unique to each Amish Mennonite community. The following is a description of the pastor selection for the Oak Knoll Amish Mennonite Community. During the time of ordination, a sequence of meetings is held Thursday through Sunday. The meetings consist of sermons from the existing three ministers about charging the congregation with the task of selecting a new minister. Usually the church has four or five ministers. The purpose of the plurality of ministers is to disperse the power of the community among several male members. Individuals in the community supposedly possess within their own place equal power. For example, the elders maintain a commitment that all men have the same power as other men, and all women have the same power as other women. However, men are the ruling body. This plurality of ministers is an outward attempt to show this masculine equality.

The first voting by the men and women who are voting members for a new minister takes place Friday; women usually vote the same way as their husbands. Around 200 members vote. For this congregation, five votes are necessary to qualify to be included in the "drawing of the lot." The candidates are male members of the congregation. They have no special training for this position. The other ministers interview these individuals on Sunday afternoon. On Sunday evening, the "drawing by the lot" takes place. The drawing of the lot consists of a Bible verse being inserted into one hymnal. Two ministers mix this hymnal with other hymnals in a separate room. Then the two ministers bring the hymnals out to the front of the

congregation, and another minister shuffles the books again. The candidates are then told to choose a book. The person who chooses the hymnal with the scripture verse becomes the new minister.

The drawing of the lot is traditional for the Oak Knoll Amish Mennonite church. Merle shares the belief that "God puts his hand on the person God wants to lead the individual to the correct book." Their belief is that God is instrumental in selecting whom God wants as the new minister. God being all powerful, he has the ability to have his chosen minister select the hymnal with the enclosed verse. One of these chosen ministers always rotates on the school board for one year. The Amish Mennonites do not see the selection as a matter of chance or probability. These chosen ministers, who are the Oak Knoll Amish Mennonite elders, are the collective voices of the congregation. The vote of these elders decides all major changes in the community. These elders or ministers have the final word on what science and technology are allowed in the community.

School Board and Decision Making. The Parent-Teacher Association, composed of the parents of Oak Knoll Amish Mennonite schoolchildren, chooses three members for the school board. One of the four ministers rotates every year, making up the fourth and final member. A chairman, vice-chairman, and a secretary-treasurer comprise the officers of the school board. They serve a three-year term, with a rotation of one per year. The school board dictates all decisions about the Oak Knoll Amish Mennonite school (see Figure 6.7).

The school board meets formally three times a year. However, if an issue such as remodeling arises, an informal gathering is held at prayer meetings. The principal, always present, puts together the agenda, but has no voting privilege.

The School Auction and Community Involvement

As presented in Chapter IV, the Oak Knoll Amish Mennonite school auction is held in October of each year. This auction is one of the primary ways of providing

Figure 6.8. The children from other Amish Mennonite Communities are seen playing around a May pole during the school auction on the school grounds. The church is in the far distance.

funds for the school's operating expenses. During the year, grandparents, parents, and children prepare for this school event. The school board generates a list of items to be auctioned off. This school auction is a very special time. For a short time, the secular world and the Oak Knoll Amish Mennonite world come together for common goals. These goals include raising money for the school, purchasing goods and services, and sharing experiences of both worlds. In the monthly Amish Mennonite newsletter, an article written by Twila recounts the school auction, a time for these two very distinct worlds to come together for a brief period of time:

> The auction began at 9:30 with the school children singing several songs and a prayer by [name of key informant]. The cotton candy, that "sweet nothing," was well-taken care of by the school girls. Jessica, who was in charge of "The Kiddy Corner" (in the school boys' little workshop), reported a very busy day as the children came by with their dollars, quarters, and dimes that they could spend. Probably the most interesting for us ladies was watching the quilts being sold and thinking of the many stitches we had put in. We did feel well rewarded by the good prices that they brought.
>
> Now there will be some meals that will be enjoyed by those who bought meal tickets, there may be some gravel and fill dirt yet to be delivered, some back hoe work, some baby-sitting jobs by school girls, even a car cleaning job. One family is also looking forward to a quarter of beef donated by Swartentruber's Meat Packing. And would you believe, the lists are already out for next year's quilting groups!

Again, the auction is the main funding source for the upkeep of the school. Most of the community members are directly involved with the sale. However, the school auction is much more than an event to raise money. This auction is a social event that includes something for every individual to enjoy (see Figure 6.8).

Figure 6.7. Members of the school board are seen contemplating an issue.

Twila alludes to members of the Oak Knoll Amish Mennonite community sensing a strong pride in seeing their handicrafts admired and sold to other Mennonite and secular individuals. Each generation finds a niche to fill, and members appreciate the contributions of all to the joint effort. Each member's contribution reveals part of the unique life cycle of the Amish Mennonites. For example, the quilting includes work from all generations of women. These quilts, made without the technology of a sewing machine, sell for $600 to $1000. Just in this brief description of the annual auction, many technologies surface: the cotton candy machine, which was borrowed from Harry who runs the ice cream shop in Jonesville; stoves, ovens, and gas grills to prepare the food; a process for meat packaging; a front-end loader for gravel or fill dirt; and a back hoe. The equipment used for working the land has many other applications. No conflict arises in using these technologies. The technologies for the school auction are borrowed from businesses and are not seen to cause dissonance in the community. In addition, many of these gatherings provide stories for the children to hear.

Oral Histories

Teaching of values and beliefs through sharing oral histories is also very important to the social environment's continuity. Many lessons in the Oak Knoll Amish Mennonite community are taught through oral history, stories, and parables.

This story describes some of the values transmitted through the Oak Knoll Amish Mennonite community:

> A great many years ago I knew a lady who had been sick for two years, dying with consumption. She had one child–a little boy named Henry. Her little boy stood by the post of the bed, his blue eyes filled with tears to see her suffer. By and by the terrible cough ceased. Henry came and put his arms around his mother's bosom, and said, "Mother, I so love you; I wish you wasn't sick."

> An hour later, the same loving, blue-eyed boy came in all aglow, stamping the snow off his feet. "Oh, Mother, may I go a-skating?" "Henry," feebly said the mother, "the ice is not hard enough yet." "But Mother," very pettishly said the boy, "you are sick all the time--how do you know?" "My child, you must obey me," gently said his mother.
>
> "I would not like to have my little boy go," said his mother looking sadly at the little boy's face, all covered with frowns; "You said you loved me—be good." "No, I don't love you now, Mother," said the boy going out and slamming the door.
>
> Again that dreadful coughing came upon her. After coughing had commenced, tears fell thick upon the pillow (Interview, June 3, 1996).

The story represents a lesson in such values as submission to the authority of parents. Colossians 3:20 says, "Children, obey your parents in all things for this is well pleasing to the Lord." This story recounts a small child not obeying his parent. As a result, the parent is hurt by the disobedient child. These values transcend time and place as they are passed from older to younger generations through the oral tradition.

Several conflicting values are seen here: the value of love between mother and child, the value of authority, and the value of obedience. The story illustrates the physical anguish experienced by the parent at the child's reluctance to obey, produced by the hurtful words that were said. This dissonance created by the conflict produces the physical pain experienced by the parent. The dissonance must be reduced, and the reduction is accomplished through the use of oral histories.

These Oak Knoll members teach their children very early lessons in community values. The probability that children will continue the tradition to limit technology is much higher if taught relevant values in their early years A related

value important to the Oak Knoll Amish Mennonite community is their connection with rural existence.

Tilling of the Soil

The Oak Knoll Amish Mennonites value rural existence so much they relocated to an area where the pace of life was much slower. Though firmly situated in an agricultural lifestyle, these Oak Knoll Amish Mennonites maintain ties with other Amish Mennonite communities throughout the United States, often traveling between communities, sometimes intermarrying. The Oak Knoll Amish Mennonites feel a connection to the soil—a tradition that they want to continue and their children to support. This tradition represents an example of physical and spiritual place. Conflict is rarely seen here with regard to the purchasing of farm machinery. For the Oak Knoll Amish Mennonite community, the Bible clearly models and gives many examples of an agrarian lifestyle that exemplifies the blending of a spiritual and physical lifestyle.

Modeling Holiness and Submission to Authority

In this community, order is strictly enforced. The order in decreasing power is God, man, women, children, animals, and plants. This control of power through a particular order continues through the life cycle. The arrangement extends from the church to individuals' roles in the school, family, and businesses. Conflict is individually felt. Only members who have left the group can discuss the suppression they experienced while in the Oak Knoll Amish Mennonite community. For community members, there is no negotiation. This order is a given. By being within a system, the members can not talk outside it.

Family

In the Oak Knoll Amish Mennonite household, the nucleus of the family consists of the father, the mother, and the unmarried children. The average family size is five. It is customary to find both parents in the home because divorce is

prohibited in the church. If the parents divorce, they must both leave the church. If a child has not married by around 30 years of age, he or she will move out of the parent's home, usually into a home for which they have invested. An invalid, elderly, or handicapped family member stays in the home and is cared for by family members.

In a particular culture, such as the Oak Knoll Amish Mennonite community, a general modeling is in place for each stage of life development. These stages include birth to puberty, adolescence to adulthood, adulthood to retirement, and death.

Birth to Puberty

The Oak Knoll Amish Mennonite children are usually born in neighboring hospitals. The Mennonites use all the technologies available to them in the hospitals. Their Oak Knoll Amish Mennonite childhood is similar to but also different from secular childhood. The child is not exposed to television, radio, professional sports, college, or public school. However, girls and boys do participate in intramural sports while they are at church or at school. Baseball, basketball, and volleyball are favorites.

Boys' clothing are no different from that of secular boys of the same age except for the occasional suspenders. However, girls' clothes are extremely different from secular garb even at a young age. The girls begin wearing the prayer cap when they first attend school. Their dresses are miniature replicas of their mothers', aunts', cousins', and grandmothers'. Again, their social environment is protected and nurtured. This protection continues in adolescence.

Adolescence to Adulthood

Adolescence, for the Oak Knoll Amish Mennonite children, is a time of tight social control. For example, a date between adolescents consists of going on a shopping spree to the mall, sitting on the porch, or interacting with parents. The

social events include activities such as fishing, swimming, water skiing, snow skiing, hunting, sewing, or making arts and crafts. This is the time when informal technology training occur through apprenticeships after the formal school day. Female and male differentiation in clothing continues through adolescence into adulthood.

Adulthood to Retirement

An Oak Knoll Amish Mennonite is considered an adult after graduating from or quitting high school around age 16. The Oak Knoll Amish Mennonite male and female may be called to the mission field for a couple of years. This may include volunteering service in a nursing home in Kansas or helping teach nutrition in Belize, Brazil, or Guatemala. On completion of their service in the mission field, most marry. With financial help from their immediate families, the couple usually builds a home and moves in once married. The home is complete with all new technologies except radio and television. The husband usually works in an Amish Mennonite-run community business or goes into business for himself. The wife works in the home but may work, for example, in a business as a housekeeper, secretary, salesperson in a bakery, or nurse in a hospital or nursing home. This lifestyle continues, with the addition of children, until retirement.

On formal retirement around the age of 65, the Oak Knoll Amish Mennonites begin another dimension of their lives. The males work in volunteer positions in the church, home, or community. They work part time as long as possible. The women continue working in the home but also have a hand in helping with grandchildren. Retirees see life as preparing them for their greater reward of life after death.

Death

Merle shares how death is viewed by the Oak Knoll Amish Mennonite community. He explains that two males are appointed funeral directors. When an individual dies, the two funeral directors and a minister go immediately to the home

of the deceased to aid the family in arrangements and to give support. The viewing of the body takes place in "the church house." The deceased is placed in an Amish-constructed coffin, chosen for its simplicity. Paul constructs the vaults in his place of business. Even in their time of bereavement, the Amish Mennonites downplay technology, choosing the most natural and simplest instruments for burial.

A short service with a message and singing is held. After a viewing by the congregation, the decreased is buried at the gravesite. For this community a feeling of rejoicing not despair is common.

Conclusion

The church is the central core from which come the values dealing with science and technology. The church is the strongest force that dictates changes in what technology may be adopted. What the church prescribes is carried out, reinforced, and taught in the community school.

For the businesses, this control of technology becomes more complicated because the businesses interact with and are dependent on the secular community for support. Therefore, FAX machines, answering machines, copiers, and computers are common in the workplace. These applications of technology are constantly being reevaluated and if found by the elders to be detrimental to the community, may be voted on by the congregation to be removed.

Examining the interactions among the distribution of technologies in the church, home, school, and businesses shows the drastic differences that exist between social agencies that are strongly linked together. Discrepancies and inconsistencies in the technologies used in each social agency can be explained by cognitive dissonance and compartmentalization. Cognitive dissonance and compartmentalization are expressed in forms of control--writing, speaking, and modeling.

Only a holistic view of daily encounters produces an understanding of science and technology in this community. The way that individual pieces are intricately woven represent a realistic picture of how science and technology are experienced among these Amish Mennonites. From this picture are lessons that I have learned.

The Oak Knoll Amish Mennonite individuals, just as any other individuals, are walking cauldrons of contradictions. Cognitive dissonance results from pressure put on the individual by conforming to group standards, creating conflict between the individual and the individual's beliefs and perceptions; this is one way of explaining these discrepancies and anomalies (Festinger, 1957). This is an ongoing process as families keep reassessing some of their beliefs about science and technology. Each generation finds itself condoning new technology adopted by the community.

This Oak Knoll Amish Mennonite community represents an agricultural society moving toward modernization and the information age, but at a much slower pace than the surrounding secular world. It indicates where we have been to better prepare us for where we are going. By studying a microculture that restricts technology, we are reminded of the stages of technological development: (1) technology follows lines of least resistance; (2) technology is used to improve previously developed technology; and (3) new directions or uses are discovered that grow from the technology itself (Naisbitt, 1984). In the Oak Knoll Amish Mennonite community, evidence is found to support stage one and two. However, no data were found to support stage three.

Allowance, acceptance, and adaptability for change in thinking about technology varies across the generations. It is with these ideas that Chapter VII is proposed. As stated in Chapter I, I now take what I have learned by stepping out of the science education community to what I consider to be a unique community in its treatment of science. Chapter VII brings me back into my own community and allows me to come full circle.

CHAPTER VII

LESSONS I LEARNED AND CHALLENGES TO BE ENCOUNTERED

What is the significance of how science and technology are used and received by a small fundamentalist sect, living in an isolated pocket of a postmodern world? What do these views and ideas mean to the rest of the world, particularly to science educators and scholars? What is the relationship between fundamentalist science students who attend private school and fundamentalist science students who attend public school? Raising questions about the role that public schools play in promoting political and social ideologies, the rights of parents to determine what their children learn, and how schools should handle values is vital to the continuation of U.S. public schooling.

Commentary

Discourses between scientists and fundamentalist Christians rarely have been studied (Roth & Alexander, 1997). Lawson and Wester (1990) and Lawson and Worsnop (1992) have found, in spite of the formal separation between science and religion, that many people do not separate these two in their personal experiences. and are unlikely to convey a distinction to their children. Therefore, when a conflict arises between scientific and religious knowledge, students have difficulties learning the subject matter of their science curriculum. Students with powerful commitments to creationists' discourse about the beginning of the universe are less prone to believe evolutionary theory than their peers. Bergman (1979) and Fuerst (1984) found that between 80 and 94% of students in several public universities in Ohio favored the instruction of creation science. Roth and Alexander (1997, p.126) remark that "in the context of high school science, we want to understand the

interaction of scientific and religious discourses, and students' management of conflicting knowledge claims within and across discourse domains." They believe that by providing students avenues and opportunities to integrate traditional scientific and religious discourses, science and religion may have a better chance of survival. This chapter presents information about such religious fundamentalist groups and their relationship to U.S. public education, conclusions from the research, and lessons learned from the study for science educators and scholars.

During the 1980s a powerful religious and social movement that has its origins in the Christian evangelical tradition resurfaced in the United States. The movement describes itself as anti-evolutionary, pro-life, pro-family, and pro-school-prayer (Provenzo, 1990). The attitudes and opinions of people in this movement are clearly aligned with those of individuals known as fundamentalists, of which the Oak Knoll Amish Mennonites are a part. I see the Oak Knoll Amish Mennonite school as an extended type of home schooling. The students work individually and independently of one another and the teacher. Home schooling, for many, is an alternative to fundamentalist Christian schools.

Religious fundamentalism has been challenging the strict secular and sacred division of public and private life since the 1930s. Even in Congress, fundamentalists' groups have lobbied for the passage of legislation supporting school prayer and tuition-tax-credits for private schools. They received President Reagan's support to introduce creationism as part of the regular biology curriculum in public schools (Provenzo, 1990).

Resistance to secular humanism unites many of these fundamentalist groups. They see secular humanism as supporting everything from evolutionary theory to pornography, from sexual promiscuity to socialism. Media, education, and government are seen by the fundamentalists as being dominated by supporters of secular humanism. Consequently, public schools have become the major

battleground in the conflict between fundamentalists and mainstream culture (Provenzo, 1990).

Despite arguments to the contrary made by fundamentalists, the U.S. was founded as a secular state. It was the first nation to constitutionally prohibit the establishment of state religions and to guarantee the free exercise of faith (Wood, 1984). Being a heterogeneous culture, it is a society based on democratic and secular political values. The national ideology of the U.S. values and embraces toleration. Ironically, the pluralism that many fundamentalists find so offensive has played a crucial role in the survival of fundamentalists as minority groups within the U.S. culture. Where else would groups that reject science and many of the foundations of contemporary knowledge so generously be tolerated and accepted (Provenzo, 1990)?

By studying an extremist fundamentalist sect like the Oak Knoll Amish Mennonites, we as science educators and scholars are able to participate in what we promote—accommodation, compromise, and empathy (Provenzo, 1990). Fundamentalists, however, are resistent to accommodation, compromise, and empathy with regard to their own value and belief systems. The questions raised by the struggles of small communities of belief, such as the Oak Knoll Amish Mennonite community, against state control are whether the foundations of microcultures can endure the political environment of U.S. schooling and the attitudes of the public toward education (Arons, 1983). The science curriculum of these Amish Mennonites is nearly contrary to public school curriculum.

Fundamentalist groups, such as the Oak Knoll Amish Mennonites, have the constitutionally guaranteed right to promote their beliefs and to maintain their practices, but not to impose their vision of culture and education on the majority of the U.S. public school students. The differences between what is represented by the Oak Knoll Amish Mennonites and U.S. public education are not simply about what

type of education best prepares students for a meaningful life but about what constitutes a meaningful life (Arons, 1983). Public schools increasingly serve heterogeneous and diverse communities. Within each community, what constitutes a meaningful life varies. Understanding and respecting these variations enables science educators to create an environment in which students from different backgrounds can learn.

U.S. public education has been built on the premise of embracing all Judeo-Christian groups and all other religious groups, not on the exclusive ideology of any one of them. However, religion has always influenced U.S. public schools. Because religious explanations of the world compete with secular science explanations of the world, conflicts are inevitable in the science classroom--overt and covert. Evolution, one of the alternative explanations for human origins, poses one of the most difficult of these conflicts (Nord, 1995). Therefore, the need to understand the competing values and belief systems of the science students, regardless of their backgrounds, is vital. The following conclusions are given as an explanation of the values and belief system of the science students in the Oak Knoll Amish Mennonite community.

Conclusions to Study

Presented below are the conclusions of this study of science and technology in an Amish Mennonite community. These conclusions are organized to structure the lessons that I discuss later in this chapter. The earlier question in the chapter, what do these views and ideas mean to the rest of the world and particularly to science educators and scholars, is addressed throughout the discussion. My emphasis, however, is on the sixth question in Chapter I: How does this Amish Mennonite school's treatment of and experience with science and technology compare to what has occurred over time in public schools in the United States? Otherwise I consider each question in the order discussed in Chapter I. Questions

one through five in Chapter I are combined into two questions in Chapter VII--question one deals with science, and question two deals with technology. Question three is question six. The questions were initially separated to find the answers; however, for better understanding for the reader, they are combined here.

I. What is science to these Amish Mennonites? What is taught in the school as science? How? What is their rationale?

My informant Paul says science is "that which is proved by the Bible" (Interview, January 22, 1995). For this Amish Mennonite community, religion is science. Using the transmission model, they teach science as a list of facts from the literal translation of the King James version of the Bible. This Bible for the Amish Mennonites gives an account of their belief in the Creation, the story of the Great Flood, and the beginning of living organisms on the earth. If asked on what their understanding of science is based, the Amish Mennonites would plainly respond, "faith." For this faith to be indoctrinated in succeeding generations, values are transmitted through all their institutions including the school, other social settings, the home, the workplace, and the church. These values are instilled early in the formal school setting by the type of science curriculum chosen by the members of the school board and are interwoven through the entire science program including physical science, physics, biology, and chemistry. The Oak Knoll Amish Mennonites use the Accelerated Christian Material Packet exclusively for their science literature. Many fundamentalist Christian groups use this material because they believe it is the most appropriate or perhaps representative of their views on science.

Science is the Oak Knoll Amish Mennonites' way of understanding the world, not only consistent with but also integral to the tenets of their religion. The Oak Knoll Amish Mennonites do not practice or even believe in a scientific method that searches for answers wherever they may be found. They may recognize facts

but not the processes of science. Science cannot be questioned because that would mean questioning their faith. Teaching science extends the principles, values, and beliefs found in the church; the science curriculum is consistent with their religious tenets. Therefore, these Oak Knoll Amish Mennonites experience little cognitive dissonance between their religious beliefs and the science they learn in school. Acceptance of both sets of beliefs is mandatory in this community.

2. What is technology to these Amish Mennonites? What technologies are found in the Amish Mennonite school? What is their rationale? How do students learn about these technologies? What are the uses to which technology is put by these Amish Mennonites in the community? How? What is their reasoning?

Technology is viewed very differently than science. Technology is that which "takes what science reveals and makes life useful" (Interview, January 18, 1995). Thus, technology is one tool that helps the community prosper. For this community to sustain itself, economic stability must be maintained. Their economic stability is dependent on the outside community's purchasing their goods and services; producing these goods and services requires use of appropriate technologies.

The school itself has limited technologies compared to what is available in many public schools: electricity, two telephones, one duplicating machine, two IBM computers, one reading machine, air conditioning and heat, two refrigerators, and two stoves. However, both male and female students apprentice in community businesses after school, and providing these environments have much richer technologies than the school.

Technologies are considered either neutral or contaminated with secular values. Examples of technology found in this community that are considered neutral are a double-edge stapler, laser guided saws, and a speaker system. Technologies prohibited by this community and considered laden with secular values include

radios, television, and computers linked to the World Wide Web. If the technology makes a particular job easier, if the technology is considered not laden with secular values, or if the technology can be used so as to avoid the inference of these values, then the technology may be embraced by the community. Technologies come through the businesses first, because they are closest to the greater secular community. Technologies are monitored to filter out secular values associated with them. The choices of technology are primarily made by which technologies are considered neutral.

Representative of the Oak Knoll Amish Mennonite community is the elementary teacher who defines technology as "man-made things to make life easier such as computers" (Interview, March 24, 1995). Because they associate technology primarily with their economic activity, the Oak Knoll Amish Mennonites see technology as separate from science.

Technology associated with apprenticeships in the community businesses prepares the student for the work place. Even though technology is limited in the school, access to informal education through these apprenticeships extends and diversifies their technological training. Some of the children were introduced to computers in industry before they were introduced to computers in school. Recent addition of computers to the school illustrates the Amish Mennonites' willingness to accept technology they consider to be neutral or that they can adapt as neutral. These computers are considered by the Mennonites as appropriate and necessary. The theory of cultural materialism explains many of the decisions reached by the Oak Knoll Amish Mennonites. Even though religion is the core of this community, what maintains the community is economic viability. This economic viability is reached through selling products and providing services.

If an issue of adapting a new technology arises, the elders of the church come together formally to discuss whether the new technology will be approved.

After lengthy discussions, voting takes place with only a positive consensus by the elders allowing the technology into the community. The same procedure is used if a technology is seen by the community as being harmful. The elders may vote on removing the technology from the community.

At the beginning of the study, I thought analysis of the technology would be straightforward because it was a small, simple, religious community that I had chosen. However, while analyzing the data, I had to add to the conceptual framework the notions of cognitive dissonance and compartmentalization. The complexity arose from the inconsistencies I found in technology used in the church, the home, the school, and the businesses. I went in search of a theory to help explain the inconsistencies. I then turned to cognitive dissonance and compartmentalization.

3. How does this Amish Mennonite school's treatment of and experience with science and technology compare to what has occurred over time in public schools in the United States?

According to the Georgia Framework for Learning Mathematics and Science (1996), science is a way of knowing that implies a critical view about how the world works. The critical thinking involved in this process are used in both formal and informal science settings. United States public schools embrace science and technology. Rigorous standards define science (AAAS, 1997; GFMS, 1996; National Research Council, 1996). Public school science students are taught the steps of the scientific method of investigation: observations, hypotheses, procedures, results, and conclusions. In addition, public schools in the U.S. promote at every turn new and innovative technologies. Thus, they become fertile soil for developing new concepts about implementing scientific ideas and using technology.

For Oak Knoll Amish Mennonites, rigorous standards, such as the scientific method, as addressed in the public school, do not exist. Science is an extension of

their religion. Rigorous standards such as the ones seen in secular science are applied to only technology in this community. Although the teaching of science as a process skill has been more widely advocated than the teaching of science through content knowledge (Hurd, 1997), historically in U.S. public schools, this rigor of science has always been the ideal. In contrast, the Oak Knoll Amish Mennonites teach science as a series of facts; no process skills are considered.

Summary

The preceding conclusions are offered in light of the idea that permeates U.S. public schools--accommodation, compromise, and empathy. I hope these conclusions allow science educators and scholars to better understand an extreme fundamentalist sect and the results that follow by excluding and dismissing all values and beliefs except what they promote. In other words, by examining an extreme fundamentalist group, science educators and scholars may better understand the fundamentalist students and their views when they enter the science classroom.

The Oak Knoll Amish Mennonite community is an extreme utopian fundamentalist sect that allows only their values and beliefs to be voiced in the community. However, as previously stated, a resurgence of fundamentalist groups has occurred, and their children can be found in the U.S. public schools (Arons, 1983). All aspects of the public school curriculum are affected such as inclusion of prayer, creationism, and a particular set of values and beliefs (Arons, 1983). With the increase of private religious schools, people who are in charge of certification of these public schoolteachers need help in dealing with the challenges science teachers face in the science classroom. Science educators and scholars need to be aware of these issues and develop a methodology to act on these ideas for the new millennium.

Lessons Learned

The following lessons are divided into two main categories--implications for the science teacher educator and implications for the science education scholar. Occasionally, the two categories overlap. The sequencing of the lessons are in the order of which I learned them in the field. The practical applications for the science teacher educator come first; then the lessons move to a more theoretically based approach for the science scholar. Finally, two lessons combine both the world of the science scholar and the science educator. The notion of lessons--the learned experience--comes from the idea of bringing a fresh perspective into the science community after observing another community operating with different ideas.

Science Teacher Educator

Lesson 1. Science teacher educators should acknowledge and appreciate science students' values and beliefs, often derived from differing worldviews, and must because of alternative conceptions of science and technology. This means considering power relationships and students' voices in the classroom.

In discussing the following lesson, I draw from twelve years of science teaching experience. The Oak Knoll Amish Mennonites remind me of the importance of acknowledging and appreciating science students' differing value and belief systems. My students came from varying worldviews. From my perspective, if I wanted them to respect and value what I said in the classroom, I had to regard and listen to my students' views as well.

Hurd (1994) suggests that education in the sciences should connect with people's daily lives, socially and biologically. This connection, including the values and belief system that make up their worldview, permeates through each facet of a student's life. Therefore, respecting science students' values and beliefs is necessary for the science educator to develop communication in the classroom. Only through shared communication can quality learning be achieved. Classroom climates where

sincere disagreements are acknowledged and respected and where appreciation of differences are reciprocal are more effective settings for science learning than are settings dictated by science educators' beliefs only (Delpit, 1995).

With differing worldviews in mind, alternative conceptions about science and technology can be examined. The first day of this study, I envisioned showing the Oak Knoll Amish Mennonite teachers how to best teach science, based on my university training, in-service instruction, and twelve years of public school teaching. It took me only a few minutes to realized that this approach would infringe on their methods of and ideas and beliefs about science teaching. I was not in my community; I was visiting another community. In this community the secular science common in public school classrooms would be rejected. Therefore, anyone coming into the community to teach science must learn the Oak Knoll Amish Mennonites' definitions of science and technology and their purposes for schooling.

Students come into a science classroom with alternative conceptions of what science is. Educators must have an awareness of these differences. Students need a safe and comfortable environment in the science classroom that nurtures their sharing of these ideas with one another. This comfortable environment can promote learning, understanding, and trust.

For example, after I had worked three years in the community, Paul asked me how many of the graduate students who had come with me to the community believed in creationist theory. Hesitantly, I said only a few. He then talked of evolution. Surprisingly, he believes, "God put things in motion, *but things do change over time*" [emphasis added]. Our strong relationship established over several years gave Paul a comfortable environment in which he could discuss alternative conceptions. Over time, we learned to respect each other's values and belief systems, and through this relationship we learned about each other's

communities. In this instance, Paul was finding ways to accommodate a central premise of scientific evolutionary theory to his fundamentalist framework.

The Oak Knoll Amish Mennonite school curriculum specifies its own school science and is not intended to represent the world of academic science as found in the public schools. The goal of their school science is directly connected to the cultural transmission of their religion. A content-product emphasis is placed on the teaching of science information rather than using the process approach favored by many U.S. public schools. This form of censorship of teaching helps impose social order and establish more of a community ideology rather than an individual ideology (Arons, 1983). The Oak Knoll Amish Mennonites find this necessary to perpetuate their community. The ideas about science and technology are regarded in the same light.

In discussing the relationship between science and technology, Coulson (1960, p. 17) describes science as "the fundamental knowledge of the world and its environment, the controlled and steady search for knowledge, without any necessary desire to use it for public ends." In comparison, Coulson (1960, p.17) views technology as " the relentless study of the ways in which things may be made, or changed: or the new knowledge of science that may be pressed into human service." This relentless quest for new avenues using technology causes compartmentalization for scientists as well as novices. Coulson (1960, p. 44) addresses the idea of compartmentalization and cognitive dissonance of science and technology by scientists just like the Oak Knoll Amish Mennonite members:

> Scientists like other men, have to live, and they prefer to do the things that interest them. They suffer from the same temptation as others to rationalize the doing of what they want to do, particularly if their living depends on it.

Coulson (1960) generalizes that all humans, even scientists, compartmentalize. This cognitive dissonance process produces anxiety in everyday life situations. No one is immune to compartmentalizing for anxiety reduction.

Learning as much as possible about the world, including the Oak Knoll Amish Mennonite community, can help shape education by examining the results of using only content or product approaches and excluding use of process skills in the teaching of science. Hurd (1997) suggests that science education can contribute to the future by developing a curriculum relevant to the world in which the student is likely to live. Roth and Alexander (1997) write,

> Although we are not claiming that science should be replaced by religion and ethics, there is a definite place for a high school course in which science, religion, philosophy, arts and other subjects are treated as parallel forms of inquiry towards the development of a 'good world'. Such a course would also allow students to experience science as but one form of inquiry, with a limited realm of applicability. Such a course needs to be truly interdisciplinary, in which no single discourse is privileged, such as in some 'science in society' courses, where scientific discourses dominate at the expense of the social and humanistic discourses. (p. 143-144)

The problem of schooling children is a microcosm of the problems associated with adulthood, and what families find missing from public schools is a cohesiveness or sense of shared values and beliefs that is absent from U.S. life (Arons, 1983). The rhetoric of schooling and the language of religion come to focus on the need for order, expressed in shared values, beliefs, and assumptions. The search for community, reflected in decisions to send children to fundamentalist Christian schools, is made more urgent by the lack of influence these parents feel over public schools. Fundamentalist Christian schools, in general, are by their own standards successful because they provide collective support and sustain shared

values and beliefs (Arons, 1983). These schools operate on a collective, organized, and sometimes hierarchical basis. The strengthening of the religious community, part through schooling, becomes an important component in sustaining individual religious freedom. The issues about which the fundamentalists are ambivalent are among the deepest issues for U.S. consciousness. Their search for a stable, religiously based microculture and for the educational means of sustaining it is an effort to resolve these issues and to institutionalize the resulting worldview. Whether in public schools or private fundamentalist schools, the central function of schooling is the same--acculturation (Arons, 1983). Acculturation can be easily transmitted through the teaching of science and technology. This acculturation is just as easily practiced in the public sector.

Because in many instances, hegemony is perpetuated as a top-down approach, voices of the individuals are easily lost. Therefore, it may be difficult for science educators to hear children's voices, because they are focused on the voices of the science community. It is often equally difficult for students to hear the science educator's voice (Delpit, 1995). Expression of voice is important to allow the science student to feel comfortable in the classroom learning environment. Only then can vital and necessary learning take place. As a result, a need for multicultural education to support where the students are and help them further along is crucial (C. Glickman, personal communication, August 5, 1998).

Issues of power also come into play in the science classrooms. These include power of the educator over the students and power of an individual or group to assess another's intelligence (Delpit, 1995). Science educators must recognize they have power over science students. This power imbalance produces an anxiety for the student that hinders learning. Therefore, each science classroom needs to incorporate strategies appropriate for all the children in the classroom. If we disempower the science students in our classrooms, we exhibit the science

educator's power as the only expert source. We also then disregard students' worldviews.

<u>Lesson 2</u>. Science teacher educators should teach a historical perspective whereby science and technology developes across time and space and should be understood in a cultural and historical perspective.

Secular science should be taught as an outgrowth of the European Enlightenment and of Western approaches to rationalism. This exercise in reason permeates the science classroom. Hurd (1994) comments that conversation about social science should be included in the science classroom. His reasoning is that this provides a way for students to learn to deal with real world issues. Access to historical events--scientific, technological, and social--gives students a clearer picture of the past to learn the lessons for dealing with the future.

Up to the end of the eighteenth century, many people used Biblical accounts to make scientific statements about the world's geological life, the creation of plants and animals, the making of and the early history of humans, and geographical facts (Rudwick, 1976). One notable example was the natural theology of Paley (Gould, 1983). Academic science, of course, grew out of the empirical tradition that suggests that humans can know things for reasons other than reliance on God or other traditional authorities (Eamon, 1992). This view of science and what constitutes its nature are incompatible with the Oak Knoll Amish Mennonite school's approach to science.

Many science students in the U.S. come to the science classroom with such indigenous science accounts taught by their cultures (Coulson, 1960). If the science educator acknowledges this and works with these historical accounts, putting them into perspective, secular science can be more easily introduced within a historical timeframe necessary to show the evolution of individuals' worldviews of the beginning of the universe.

Lesson 3. Science educators should be aware of how students may compartmentalize science and religion in their thinking.

Many science students unconsciously compartmentalize their scientific and their religious views of the world. Science educators are in a position to help students integrate the two to achieve a more complete, coherent view of the world. As emphasized in Chapter II, science and religion do have some common goals. In some cases, both seek to explain the human condition, its origin, and its future. Much of humanity has turned to science and technology as a source of fulfillment and hope.

Scholars have attempted to understand the relationship between science and religion (Barbour, 1989) indicates that, for some people, science seems to be the only reliable path to knowledge. Other people assert that religion has its own distinctive ways of knowing, quite different from those of science. Barbour (1989) proposes four ways to approach the understanding of the relationship between science and religion.

1. Conflict: In this approach claims are made between science and religion making rival literal statements about the same domain and the history of nature so that one must choose between them.

2. Independence: This approach views religion and science as totally independent and autonomous. The purpose is to avoid unnecessary conflicts and be faithful to the distinctive characteristics of each area of life and thought.

3. Dialogue: This approach involves some indirect interactions between science and religion involving boundary questions and methods of two fields. For some scientists, exposure to the order of the universe, as well as its beauty and complexity, is an occasion of wonder and reverence.

4. Integration: This approach holds that some sort of integration is possible between the content of theology and the content of science. This argument uses both

science and religion to contribute to the development of an inclusive metaphysics. Metaphysics is the search for a set of general categories in terms of which diverse types of experience can be interpreted. Metaphysics can serve as an arena of common reflection between the scientists and the theologians. From my observations, the Oak Knoll Amish Mennonites fall into the category of conflict. I suspect the general public falls in the category of independence, keeping the world of science and religion separate. I think I was raised with the independence approach; however, I now fall into the category of dialogue after spending so much time reflecting on the relationship between science and religion.

The process of the brain compels humans to compartmentalize (Festinger, 1957). Each day people are bombarded with new information. As discussed in Chapter VI, cognitive dissonance and compartmentalization are human ways of creating order and sense of this information. This new information comes to individuals through such avenues as the sciences, new technologies, our society, and the economy (Hurd, 1994). Science teacher educators must understand and help science students deal with information overload. Consequently, science teacher educators need to understand this idea of compartmentalization and that this is a normal human reaction that most people, including science students, engage in. With this in mind, science teacher educators may be more aware of the cultures their students bring into the classroom.

Science Education Scholar

Lesson 1. Understanding people's views of science and technology requires time spent collecting information and reflecting on it.

I began the study with a plan to spend six months in the Oak Knoll Amish Mennonite science classroom, thinking this would be sufficient to answer my research questions. Obviously, this plan failed to do more than scrape the "scientific surface." Choosing an ethnographic approach, as explained in Chapter I, provided

me ample time to construct a more accurate and comprehensive image of the Oak Knoll Amish Mennonites' view of science and technology.

The ample amount of time provided a sharper focus to see that for this group science and technology was defined differently from the secular point of view. The element of time showed how the Oak Knoll Amish Mennonites accomplished the compartmentalization of technologies among church, school, home, and businesses.

Since the Enlightenment scholars have argued, refined, and disputed each others' definitions of science, but not until recently have they given comparable attention to defining technology. Among the Oak Knoll Amish Mennonites, the reverse is true: science comes from their faith, so science cannot be critically examined. Because this community separates science and technology, they do examine technology critically. In other words they ask," Do we give up something in exchange for new technology? If so, what is it? Is it worth it? Can we reverse the decision? How do individuals keep up with rapid changes in technology?"

An example of technology critically examined is the addition of computers to the school. During my field study, the elders have been debating whether to teach word processing in the school. Paul says that children need to learn to use word processors because they are integral in the workplace. However, the Oak Knoll Amish Mennonites see connections to such resources as the Worldwide Web as corrupting. On the basis of my observations, I believe that easy access to the Web is too tempting for their children. The elders have chosen not to take the chance of exposing the community's children to values other than their own. The resolution has been to install computers in the school that have no internet access. As of February 1998, the issue of implementing computers in the school has been resolved. Two IBM computers have been added. Software includes Microsoft Works, Microsoft Money, Read Master, Typing Quick and Easy, and Type to Learn.

The discussion had been ongoing for ten years. The cognitive dissonance around this conflict has been lessened.

I believe many educators strongly critique science, but embrace technology without looking at all its ramifications. By examining the Oak Knoll Amish Mennonite community, science educators and scholars can see the implications of accepting science only on faith and learn from them lessons about how reflection on technological adoptions may change their lifestyle and, therefore, their worldview.

These attitudes and skills are important qualities for the workplace. Hurd (1997) mentions the need for focusing on what is required in the workplace. Work is now conceptualized as learning and thinking for making a living along with acquiring capital. Linking more closely school and work has become an integral initiative of science education.

For example, in the Oak Knoll Amish Mennonite community members use selected information from science and apply technology but ignore those scientific concepts and principles that challenge their beliefs. Applicability is the most important factor in using a particular technology. As a result, their purposes for science and technology differ from those of other communities. What science is taught in the classroom, whether speaking to the U.S. public school classroom or a fundamentalist sect, becomes a question of ownership--whose science is being taught? Whose science is taught becomes problematic with the implementation of the National Science Curriculum and a push for scientific literacy.

Lesson 2. Science education scholars need to research how science and technology should be integrated in the curriculum. Science education scholars need to understand that technology changes faster than other elements of culture.

This study of Oak Knoll Amish Mennonites demonstrates how technological advances are changing cultures rapidly. These advances transform society so fast

that people have difficulty catching up with them. Even though advancements in technology are exponential, an increasing number of people are living in poverty, more individuals are homeless, more people commit suicide, and more individuals lack healthcare than any other time in U.S. history (Hurd, 1997). Just as importantly, more people are having difficulty adapting to a changing society and understanding the changing world of work and, therefore, themselves (Hurd, 1997).

To further explain, the shift from an agricultural to an industrial society took 100 years; however, the present change from an industrial to an informational society has taken only 20 years to date. For example, consider for a moment the plethora of changes that the microcomputer has undergone in the past five years. Changes are occurring so rapidly that people have no time to adapt.

When the United States was primarily an agricultural society, time was oriented to the past. Farmers learned from the past how to plant, to harvest, and to store their products. In contrast, an industrial society's time orientation is now. In industry with the production line, such as in the car or clothing industry, the objective was to get the merchandise made and get it out to the market (Nasbitt, 1984). However, in the new information society, time orientation for product development is toward the future.

Many groups in the United States have all three societies—agricultural, industrial, and technological—simultaneously. For example, the Oak Knoll Amish Mennonites are only presently moving from an agricultural to an industrial society with only glimmers of an information society at best. The agricultural community pits humans against nature. In an industrial society, the strategy becomes humans versus fabricated nature. In an information society, the strategy becomes people interacting at many levels with other people (Nasbitt, 1984). What does this new information society and the ability to communicate with people mean in terms of public schooling? One answer may be that, by keeping an open dialogue in the

science classroom to discuss the nature of new knowledge in this informational society and its relationship to understanding the changing world, the students will be better prepared.

The children of the Oak Knoll Amish Mennonite community are nurtured spiritually, physically and mentally. The teachers in the school are only part of this nurturance. Other individuals in the community also teach the children. The community takes responsibility for the teaching of the children. Paul, my key informant, says that he feels like the caretaker of a greenhouse. He nurtures the plants, who are the students, spiritually, physically, and mentally, until the plant, the student, is ready to be transplanted outside to the secular world. Perhaps, if we teach our public students holistically, just as the Oak Knoll Amish Mennonites do, we can better prepare them for the rapid changes that they will encounter. The more we can educate our students on how to cope with the idea that technology changes faster than society, the better prepared students will be for the future.

Lesson 3. Science education scholars need to understand that cultural transmission is part of the purpose for schooling.

All societies depend on cultural transmission. Around the world, the purposes of cultural transmission remain the same: (1) to maintain the community, (2) to manage cultural change, (3) to moderate external influences (deMarrais & LeCompte, 1995). Members of the Oak Knoll Amish Mennonite community believe their school should teach students a specific heritage and set of values unique to their order. Members recruited from outside the community must relinquish their previous identities. They assimilate and take on the Oak Knoll Amish Mennonite values and standards. This includes donning the conventional dress and relinquishing certain proscribed technologies.

The matter of belief, worldview, personal conscience, and group identity that underlies school struggles also has significant political implications. The battles

between families and school officials for the consciousness of children are, therefore, more than a struggle over the expression of dissenting values in present-day schooling (Arons, 1983).

To what extent should the public schools be agents to preserve our culture, and to what extent agents to change it? Given the diverse and competing views that face public schools presently and in the future, it is certain that the purpose of public schools and their curricula will be key objectives of political struggles. In recent times, the fast rate of social change has increased the tension between old and new ideas and between mainstream and minority cultural values. Also, this rate of social change has dramatically affected changes in curriculum policymaking (Boyd-Barrett, 1979).

Elboim-Dror (1970) notes,

> It might be satisfactory for an organization that only tries to adjust itself to a stable and slowly changing environment, but it does not suit a rapidly changing and demanding environment to successfully meet its many demanding tasks and missions; it will have to find new and more dynamic decision strategies. (p. 247)

The Oak Knoll Amish Mennonites are a living example of the processes and decisions we made thirty years ago in the United States.

<u>Science Teacher Educator and Science Education Scholar</u>

<u>Lesson 1</u>. **Science educators should foster a dialogue in using technology in scientific research. Science educators need to clarify the purpose of teaching science and technology in the public school. Technology must be as critically examined as secular science is. Science education scholars need to continue to research alternative microcultures' definitions about science and technology.**

Barbour (1989) says the direction of technology involves ethical values such as justice, freedom, and the environment. Wisdom is necessary for applying

technology in the world. This balancing of technological responsibility with technological growth is a necessary component to present to science students in public schools. Science students must learn how to critically examine technology as well as science.

When I first began studying the Oak Knoll Amish Mennonite School, I perceived their technology as very limited; however, the Amish Mennonites are highly recognized throughout North and South America for their technological skill (Document, June 28, 1995). How do people become so skillful when they control tightly the technology they adopt? The technological skills of the Oak Knoll Amish Mennonite community resulted from more than just formal education. Consequently, I had to investigate the types of technologies found in this community, discovering how the workers learned the technologies and uncovering the relationship between business and the community school. The transition from school to community took time and required a willingness to reexamine my previous held concepts and to consider the technology from the Oak Knoll Amish Mennonite perspective. Hurd (1994) cautions that, today in the U.S. from age one to eighteen, one-third of learning comes from family and community. Science educators should understand what students are learning about technology outside the science classroom.

What are the justifications for teaching science and technology? In the Oak Knoll Amish Mennonite community, teaching science is equated with teaching religion. The Oak Knoll Amish Mennonite community is very thoughtful about adopting technology in the school and in the community. Their separation from the secular world is built on the ideology of prohibiting technologies that they perceive as laden with secular values.

As summarized in Chapter II, the purpose of secular science education is to promote understanding of the natural world, and the goal of technology is to make modifications in the world to meet human needs. Science and technology are

intimately related in Western culture. Any specific problem frequently has both a scientific and a technological component. The need to address questions about the natural world drives the progress of technology. Similarly, technology needs can drive scientific research (National Research Council, 1996).

However, in the formal and informal educational processes of the Oak Knoll Amish Mennonites, science and technology are compartmentalized into different categories. The science and technology of the Oak Knoll Amish Mennonite community is a system providing generalized rather than highly specialized training for employment. The students possess skills allowing them to adapt to other jobs if whatever they are doing becomes obsolete. Formally, the Oak Knoll Amish Mennonites teach their children reading and general math in school as preparation for the work place. Informally, the Oak Knoll Amish Mennonites teach, through apprenticeships, work ethics and skills. On the surface, the student learns early responsibility, reliability, and cooperation. These attitudes and skills carry over to any job, anywhere in the workforce. Hurd (1997) mentions the need for focusing on what is needed to be successful in the workforce. Work is now conceptualized as learning and thinking for making a living. Linking more closely school, technology, and work has become an integral initiative of science education.

Technology has offered humans power, control, and the prospect of overcoming our helplessness and dependency (Barbour, 1989). Barbour (1989) suggests technology has not brought the personal fulfillment or social well-being it promised by being powerful beyond our control.

Specific attitudes toward and skills for technology are important qualities for the workplace. Science students' values and beliefs about whether or not scientific knowledge is amoral, tentative, empirically based, a product of human creativity, or avariciousness reflect individuals' conceptions of the nature of science (Lederman, 1992). As a result, science educators and scholars have consistently advocated for

improving science students' understanding of the nature of science (Lederman, 1992). Saunders (1955) has even suggested that the understanding of the nature of science is the most important purpose of science teaching.

<u>Lesson 2</u>. U.S. public school science educators and scholars should consider integrating and respecting the ways science and technology are taught in other communities in this country and around the world, rather than expecting these communities to adjust to mainstream methods of teaching science.

Finally, I charge science educator teachers and scholars with this final lesson. The original thought comes from Dewey (1938) about the goal of public education. Dewey says that "the main purpose or objective [of public education] is to prepare the young for future responsibilities and for success in life." He suggests that books represent the wisdom of the past, and teachers connect the past with what is presently taught.

Only with a comfortable science classroom environment and an openness for teachers to understand who their students are can we maximize learning. Teachers are crucial to the development of the science student. They have a stake in guiding students to continue in the science field. As a result, a community of science learners that includes the teacher must be established in the classroom.

This community has prospered in the midst of a secular world despite their rejection of mainstream science. This study of science and technology in the Oak Knoll Amish Mennonite community shows how science and technology are taught to the youngsters by all the adults across many settings. Their instruction, including the apprenticeship, is so practically oriented that young people are prepared well for community occupations. The general skills they learn permit them flexibility when changing technologies and conditions impel changes in these occupations. The work

ethic emphasized in Oak Knoll Amish Mennonite schooling is valued and reinforced in the community.

Barbour (1989) contends that science must be taught through a wider lens. Using an interdisciplinary approach of teaching science with the arts and religion strengthens the learning of the science student. It gives a holistic perspective to these crucial issues that must be dealt with in the future. Approaching the future, an "education is seen as one that helps connect students with the natural world, the culture, work, society, and most of all oneself" (Hurd, 1994, p.18). After all, we are a global community.

REFERENCES

Accelerated Christian Education curriculum. (1993). Lewisville, TX: Christian Accelerated Education, Inc.

American Association for the Advancement of Science. (1997). Benchmarks for scientific literacy. New York: Oxford University Press.

Anderson, E. (1996). Ecologies of the heart. New York: Oxford.

Arons, S. (1983). Compelling belief. New York: McGraw-Hill.

Arsenberg, C. & Kimball, S. (1940). Family and community in Ireland. Cambridge, MA: Harvard University Press.

Barbour, I. (1989). Science and Religion. New York: Harper & Row.

Barbour, I. (1991). Religion in an age of science. New York: Harper & Row.

Bergman, J. (1979). The attitude of university students toward the teaching of creation and evolution in the schools. Origins, 6, 60-70.

Bernstein, R. J. (1983). Beyond objectivism and relativism: Science, hermeneutics, and praxis. Philadelphia: University of Pennsylvania Press, p. 284.

Boyd-Barrett, O. (1979). The curriculum: A question of control. New York: Open University Press.

Bidney, D. (1967). Theoretical anthropology. 2nd Ed. New York: Schocken Books.

Biological Science: An ecological approach. (1982). Dubuque, Iowa: Kendall/Hunt.

Bulmer, H. (1969). Symbolic integractionism: Perspective and method. Englewood Cliffs, NJ: Prentice Hall.

Chang, H. (1991). American high school adolescent life and ethos: An ethnography. New York: Farmer Press.

Coulson, C. (1960). Science, technology, and the christain. New York: Abingdon Press.

Craumer, P. (1995). Rural and agricultural development in uzbekistan. London: Royal Institute of International Affairs.

de Marrais, K. & LeCompte, M. (1995). How schools work: A sociological analysis of education. New York: Logman.

Delgado-Gaitan, C. & Trueba, H. (1991). Crossing cultural borders. New York: Falmer Press.

Delpit, L. (1995). Other people's children: Cultural conflict in the classroom. New York: The New York Press.

Dewey, J. (1938). Experience and education. New York, NY: Macmillian Publishing Company.

Dreeben, R. (1968). On what is learned in school. Reading, MA: Addison-Wesley.

Durkheim, E. (1969). The division of labor in society. New York: The Free Press. [First published in 1893].

Dyck, C. (Ed.). (1967). An introduction to mennonite history. Scottdale, PA: Herald Press.

Eamon, W. (1994). Science and the secrets of nature. Princeton: Princeton University press.

Elder, J. & Wong, H. (1994). Family of earth and sky: Indigenous tales of nature from around the world. Boston: Beacon Press.

Elboim-Dror, R. (1972). The management system in education and staff relations: Part 2. Journal of Educational Administration and History, 4(2), 47-56.

Emerson, R. (1983). Contemporary field research. Illinois: Waveland Press.

Fagnano, C. & Werber, B. (1994). School, family, and community interaction. San Francisco: Westview Press.

Festinger, L. (1957). Conflict, decision, and dissonance. Stanford, CA: Stanford University Press.

Fuerst, P. (1984). University student understanding of evolutionary biology's place in the creation/evolution controversy. Ohio Journal of Science, 84, 218-228.

Georgia Framework for Learning Mathematics and Science. (1996). Athens, GA: The University of Georgia.

Goodeough, W. (1976). Multiculturalism at the normal human experience.

Gould, S. J. (1983). Hen's teeth and horse's toes. New York: Norton, 413.

Geertz, C. (1973). The interpretation of cultures: selected essays. New York: Basic Books, 25.

Harris, M. (1979). Cultural materialism: The struggle for a science of culture. New York: Random House.

Haviland, W. (1996). Anthropology. (7th ed.). New York: Harcourt Brace College Publishers.

Heimler, C. & Price, J. (1989). Focus on physical science. Columbus, OH: Merrill.

Hocking, P. (1995). Principles of visual anthropology. New York: Mouton de Gruyter

Hollinger, R. (1994). Post modernism and the social sciences: A thematic approach, 4. Thousand Oaks, CA: Sage.

Holloway, M. (1951). Heavens on earth: utopian communities in America. New York: Library Publishers, p. 227.

Hostetler, J. (1983). Amish society. Baltimore, MD: John Hopkins.

Hostetler, J. (1974). Communitarian societies. New York: Holt, Rinehart, & Winston.

Hostelter, J. & Huntington, G. (1981). Amish children: Education in the family, school and community. (2nd ed.). Fort Worth, Texas: Harcourt Brace Jovanovich.

Hurd, P. (1997). New minds for a new age: Prologue to modernizing the science curriculum. Science Education, 78(1), 103-116.

Johnson, J. (1975). Doing yield research. New York: Free Press.

Jolly, C. & Plog, F. (1990). Anthropology: decisions, adaptation, and evolution. (2nd ed.). New York: Knopy.

Kephart, W. (1987). Extraordinary groups: An examination of unconventional lifestyles. (3rd ed.). New York: St. Martin's Press.

Kingston, W. (1990). Innovation, creativity, and law. Boston, MA: Kluwer Academic Publisher.

Kluckhohn, C. (1948). Personality in nature, society, and culture. New York: A. A. Knopf.

Kraybill, D. & Olshan, M. (1994). The amish struggle with modernity. New Hampshire: University Press of New England.

Kraybill, D. (1989). The riddle of amish culture. Baltimore: The Johns Hopkins University Press.

Kuhn, T. (1970). The structure of scientific revolutions. 2nd ed. Chicago, IL: The University of Chicago Press.

Langin, B. (1993). Aus deutschen werden americaner: die geschichte der deutschen einwanderung in die neue welt. Wien, Germany: Osterreichische Landsmannschaft.

Langin, B. (1994). Plain and amish. Scottdale, PA: Herald Press.

Lawson, A. & Weser, J. (1990). The rejection of nonscientific beliefs about life: Effects of instruction and reasoning skills. Journal of Research in Science Teaching, 27, 589-606.

Lawson, A. & Worsnop, W. (1992). Learning about evolution and rejecting a belief in special creation: Effects of reflective reasoning skills, prior knowledge, prior belief and religious commitment. Journal of Research in Science Teaching, 29, 143-166.

Layton, D. (1993). Technology's challenge to science education. Developing science and technology series. Bristol, PA: Taylor & Francis.

LeCompte, M. & Preissle, J. (1993). Ethnography and qualitative design in educational research. New York: Academic Press.

Lederman, N. (1992). Students' and teachers' conceptions of the nature of science: A review of the research. Science and Mathematics Education. Oregon State University.

Lincolm, Y. (1986). The development of intrinsic criteria for authenticity: A model for trust in naturalistic research. Paper presented at the meeting of the American Educational Research Association.

Linton, R. (1945). The cultural background of personality. New York: Appleton-Century.

Lovece, F. (1996). The X-files declassified. Secaucus, NJ: Citadel Press.

Makenzie, D., & Wajcman, J. (1985). The social shaping of technology. Philadelphia, PA: Open University Press.

Marx, K. (1973). On society and social change. Chicago: University of Chicago Press.

Martin, J. (1992). The school/home: Rethinking schools for changing families. Cambridge, MA: Howard University Press.

Maybury-Lewis, D. (1992). Millennium: Tribal wisdom and the modern world. New York: Viking, 397.

McConney, A. (1994). Toward a unified model: The foundations and educational personal evaluation. Kalamazou, MI: Western Michigan University.

McIrving, E., Congart, W., Kean, R., deCarlo, C., Bloy, M., Landau, J. & Theobald, R. (Eds.). (1967). Dialogue on technology. New York: The Bobbs-Merrill Company.

Mead, M. (1928). Coming of age in Samoa: A psychological study of primitive youth for Western Civilization. New York: William Morrow.

Merton, R. (1967). Social theory and social structure. New York: The Free Press.

Milbrath, L. (1989). Envisioning a sustainable society. New York: State University of New York Press.

Murphy, J., Hollon, J., Zitzewitz, P. (1986). Physics: Principles and problems. Columbus, OH: Charles E. Merrill.

Naisbitt, J. (1984). Megatrends. New York, NY: Warner Books.

National Science Education Standards. (1996). National Research Council. Washington, DC: National Academy Press.

National Research Council. (1996). National science education standards. Washington, D.C.: National Academy Press.

Nord, W. (1995). Religion and american education. Chapel Hill, NC: The University of North Carolina Press.

Ogbu, J. (1974). The next generation. New York: Academic Press.

Parkins, D. (1985). The anthropology of evil. New York: Basil Blackwell Ltd.

Parson, T. (1959). the school class as a social system: Some of its functions in american society. Harvard Educational Review, 29, 297-319.

Peacock, J. (1987). The anthropological lens. New York: Cambridge University Press.

Provenzo, E. (1990). Religious fundamentalism and american education. New York: State University of New York Press.

Redekop, C., Ainlay, S., & Siemens, R. (1995). Mennonite entrepreneurs. Baltimore: The Johns Hopkins University Press.

Reiss, M. (1993). Science education for a pluralistic society. Philadelphia, PA: Open University Press.

Roszak, T. (1969). The making of a counterculture: reflections on the technocratic society and its youthful opposition. Garden City, N.Y.: Doubleday.

Roth, W. & Alexander, T. (1997). The interaction of students' scientific and religious discourses: Two case studies. Interactional Journal of Science Education, 19(2), 146.

Rudwick, M. J. (1976). The meaning of fossils: Episodes in the history of paleontology. New York: Neale Watson Academic Publications, Inc.

Saunders, H. (1955). The teaching of general science in tropical secondary schools. London: Oxford University Press.

Schlabach, T. (1988). Peace, faith, nation: mennonites and amish in nineteenth century america. Scottdale, PA: Herald Press.

Speck, c. & Prideaux, D. (1993). Fundamentalist education and creation science. Australian Journal of Education, 37(3), 279-295.

Spindler, G. (Ed.). (1982). Doing the ethnography of schooling. New York: Holt, Rinehart, & Winston.

Spradley J. & McCurdy, D. (Eds.). (1972). The cultural experience: Ethnography in complex society. Chicago: Science Research Associates.

Spring, J. (1996). American education. New York: McGraw-Hill, Inc.

Stout, D. (1956). School-community leadership. Iowa: Wm. C. Brown Company.

Tocci, S. & Viehland, C. (1996). Chemistry: Visualizing matter. Orlando, FL: Holt, Rinehart, & Winston.

The King James Version of the Holy Bible

Tylor, E. (1858). Primitive culture. New York: Harper Torchbooks (originally published in 1871).

U. S. Bureau of the Census. (1986). Statistical abstract of the united states: 1987. (107th ed.). Washington, DC: U. S. Government Printing Office.

Warren, R. (1967). Education in rebhausen: a german village. New York: Holt, Rinehart, & Winston.

Watts, F. N. (1988). The psychology of religious knowing. New York: Cambridge, 169.

Weast, R. & Lide, D. (1990). CRC handbook of chemistry and physics. Boca Raton, FL: CRC Press.

Wolcott, H. (1995). The art of fieldwork. Walnut Creek, CA: Alta Mira.

Wolcott, H. (1973). The man in the principal's office: An ethnography. New York: Holt, Rinehart, & Winston.

Wolcott, H. (1967). A kwakiutl village and school. New York: Holt, Rinehart, & Winston.

Wood, J. (1984, May). The christianization of the public schools. Paper presented at the national meeting of the Anti-Defamation League of B'nai B'rith. New York City.

Znaniocki F. (1934). The method of sociology. New York: Farrar and Rinehart.