Report submitted to:

Professor Lorraine Higgins

Brian Benson

Rachel Katz

Aaron Nahabedian

In cooperation with

Professor Ronald Arrieta Calvo,
Centro de Investigación de Contaminación Ambiental

Designing Educational Materials for Composting in a Costa Rican Community

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Executive Summary

Costa Rica is a country known for its beauty and unique biodiversity. However, this exceptional country is currently faced with an increasing population paired with an increasing need to manage waste more efficiently. This growing problem is cause for much concern among the Costa Rican people. The landfill system is in a state of turmoil as landfills have reached capacity and some are closed. As a result of this waste management problem Professor Ronald Arrieta of San Jose, Costa Rica asked our team to explore methods of promoting composting as a method of efficient waste management. The essential goal of this project was to create an instructional video on how to compost for the residents of San Jose, Costa Rica.

To accomplish this objective our team researched societal, cultural, and geographical aspects of Costa Rica. We then analyzed our intended audience. Using this information we researched different methods of composting and chose four appropriate methods that could be used by residents of Costa Rica. These methods are the garbage can method, wire mesh method, six hole method, and worm composting method. Each of these methods suits a different situation allowing nearly all residents to compost. The garbage can composting method needs little yard space and is easy to care for. The wire mesh composting method needs more land and care, but creates higher quality compost. For discrete and easy to care for composting, we suggested the six hole method. Worm composting was selected because it can be done indoors.

Different techniques and theories on instructional techniques were researched and a script was written. The population composition helped us decide what format the video should be. Our targeted audience had access televisions, computers, VHS, and DVD. This helped us choose the format of the video. It was also important that the video could be played all at once or have individual portions played. For these reasons the team decided to format the video as a DVD. The team then filmed, edited, and produced a twenty minute instructional video on how to compost. After the completion of the video, we analyzed and made suggestions for video's distribution and projects involving composting in other communities.

Our completion of this project has yielded an instructional DVD capable of being viewed in a classroom or home setting. It will aid in educating the San Jose populace, through Professor Arrieta's distribution of the video, about the importance of composting and efficient waste management. This will contribute to solving Costa Rica's waste management problem and help to preserve the beauty that makes Costa Rica unique.

Abstract

This project consists of an instructional composting video to help reduce the amount of waste produced in San José, Costa Rica, a country whose unique environmental resources are being threatened by overburdened landfills. The climate and waste management practices of the region, the science of composting, and our target population were analyzed in order to produce accurate content and an effective instructional approach. Four methods of composting are presented in an interactive DVD format, suitable for classroom and home viewing.

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CHAPTER 1: INTRODUCTION

As our society moves through the twenty-first century, we are encountering serious environmental problems, largely due to an increasing population whose effects can be seen on a global and local scale. Continuing environmental problems of waste management necessitate immediate action. Earth's population is larger then it ever has been before. Earth's population in 2002 was 6.2 billion people and is growing by 77 million persons annually. Scientists estimate that Earth's population will peak at 10 billion in 2200 (Colombia, 2007). As the population grows, the resources necessary to support life increase considerably, as does the waste we produce. Currently in the United States, each person produces 4.5 pounds of garbage a day, an increase from just 2.7 pounds a day in 1960 (EPA, 2006). Society is growing so fast that finding a location to dispose the waste is becoming a difficult task. A possible solution to this problem is more efficient use of our resources.

Most of our key resources, such as food and water, are renewable, but some resources, like land, are not. Water can be processed and filtered. Food can be grown. Renewable energy is available in the forms of wind, geothermal, tidal, and solar power. Breathable air is constantly being renewed by photosynthesizing plants (CCPO). However, one resource that is not renewable is land. This space is limited. Adam Smargon (1999) pointed out that the largest monument built by a new world order civilization was the Temple of the Sun in Mexico 2,000 years ago. Its size occupied thirty million cubic feet. The landfill outside of San Francisco, which is made up of garbage from 1977 to now, currently occupies seventy million cubic feet. Smargon made the comparison that one of the greatest monuments in human history is dwarfed in size by the mound of trash produced by a few cities. The Staten Island Landfill receives twenty-two thousand tons of garbage daily from New York City (Smargon, 1999). Production and waste pollutes this environment that we share with trillions of other organisms. In order to protect the earth and its inhabitants, we need to think about how our actions affect the future.

Most nations have not changed their waste management to more environmentally friendly methods. Preserving areas of the planet with fragile, diverse ecosystems is of the

highest importance in making a lasting change for the future. This is especially true for Costa Rica because of the diversity and density of its natural resources. Costa Rica represents a unique corner of our world that requires protecting. According to the Costa Rica Embassy (2007) the country makes up only .03% of the surface of the planet but contains approximately 6% of the world's biodiversity. Costa Rica has already put about 28% of its territory under environmental protection. While this is an important step in the right direction, more has to be done to ensure that the land is protected and that society can thrive while maintaining a concern for the environment (Costa Rica Embassy, 2007). The Colombia Encyclopedia (2007) cites that at Costa Rica's current growth rate, the population will double in 19 years. There needs to be enough land available for this growing human population to inhabit. The current waste management system of landfills is not space efficient and is wasting renewable resources. The available land can be used effectively if the population starts taking advantage of its renewable resources, such as organic waste. If Costa Rica were able to cut down on its solid waste disposal, it would have noticeably positive long term effects on the environment and the amount of land available for habitation.

Currently in Costa Rica, most of the solid waste is managed by disposing of it in landfills. The Central Valley region, which includes the capital, San José, contains a little less than half of the total population of Costa Rica (The Costa Rica Guides, 2007). This large population density makes this an ideal location to concentrate on trying to improve waste management. Our projects sponsor, Professor Ronald Arrieta Calvo of the Centro de Investigación de Contaminación Ambiental in San José, has concerns about the current waste management system. He has asked our project team to assist him in developing a solution to help solve this problem.

In twenty years, the amount of waste produced in the city of San José has increased from 250,000 tons in 1978 to 385,000 tons in 1999 (Shruti et al, 2002). San José's main landfill, Rio Azul, was closed in August of 2007 as a result of overuse and mismanagement (Mora, n.d.). They have since opened a new landfill to handle the solid waste. This problem will not be solved unless there is an active effort to fix it. The best way to solve a problem is to start with the largest contributing factor. With a population of 2.1 million in the San José region, a majority of the waste is produced by the people

rather than corporations and industry (Profile, n.d.). If each person cuts down on the waste they produce, the overall result would be evident.

A solution to the waste management problem is to eliminate the organic waste that is disposed of in landfills. This solution was suggested by our sponsor. It is an easy and an economical answer. Ideally, every household would compost their biodegradable waste. This would cut down on the amount of solid waste brought to the landfills. Composting would recycle the biodegradable waste in a safe and productive manner. Compost is good for using in gardens or the lawn. According to Professor Arrieta nearly every resident of the San José region has a garden, lawn, or potted plants (personal communication, Nov. 7, 2007). Compost can be used productively. However, this ideal situation is not reality. According to Professor Arrieta there is currently no community or landfill composting program in the San José area. The general population may not have the motivation, method, or knowledge to compost.

Professor Arietta is working to develop an educational composting program. He believes that the reason people aren't composting is strictly because of a lack of knowledge. Other countries have successful composting programs. Existing research and literature could be applied or adapted for use in Costa Rica. There is a gap of research on how to implement a similar program in Costa Rica.

Lack of motivation, knowledge, and resources must be addressed in order for composting to work in San José. Motivation is directly related to the culture and current knowledge of the environment. The forests and biodiversity is a source of pride for the people, but there are no current programs to inform the public about how to compost and how it will help the environment. In addition, we need to seek out the best methods for motivating. To do this we will analyze their culture. We will use the information that we obtain on the audience to decide the best way to interest them in composting. A video will be filmed and geared towards the audience.

There have been government efforts in Costa Rica to increase the amount of recycling and composting. The government has tried passing laws to increase the level of recycling. These laws have been ignored due to lack of enforcement and programs to educate people about composting (Nelson, 2007). If the public were aware of the current environmental problem and had instructions on how to compost, the problem could begin

to be solved. The people of San José would be amazed at how much could be accomplished with minimal effort. We can provide information for the inhabitants of the San José area.

In order to assess the solution to the waste management problem, our team researched the following areas: general information on Costa Rica, current waste management, and composting. General information on Costa Rica enabled us to better understand the culture and environment. Researching the current waste management and composting efforts helped us to see what previous attempts had been made. From this we learned what successes and failures had resulted. Our research allowed us to better understand Costa Rica's and San José's specific problems relating to waste management, which then enabled us to produce a better directed and appropriate solution. We were able to effectively choose and teach composting through researching the science behind it. Wire mesh composting, worm composting, trash can composting, and six hole composting methods are the most appropriate methods of composting for those living in the San José area.

Our team created an instructional video that details the global and local problem, how the citizen's actions can make a difference, how they can act by composting in their homes, and how to compost. The information needed to help Costa Rica's environment is provided in this video. The video is an interactive, informational medium that will catch the interest of the viewer. The video is more appealing than a set of laws or brochures. To effectively design this video, we analyzed our audience, learned about composting methods, researched books outlining techniques on writing instructional text, watched preexisting instructional videos, and evaluated different video software programs.

The importance of protecting our environment on the local and global scale is paramount. Land is our most valuable resource and it is one that is not renewable. This video will have the ability to enter the homes of the San José populace and explain to them in an entertaining, simple, and meaningful way how they can help solve a global issue. All that is needed from the viewer is a little more attention to their biodegradable waste. Composting in the home will decrease the amount of solid waste in the landfills and help to protect the unique biodiversity that helps to define Costa Rica.

CHAPTER 2: BACKGROUND

Waste Management in Costa Rica is increasingly a problem as the amount of solid waste discarded increases and space to dispose of the waste decreases. In particular, the municipality of San José has tripled the amount of waste produced between 1978 and 1999 (Shruti et al, 2002). The problem has grown to the point that the government and landfill officials have had to shut down landfills. Part of the solution to waste management issues may be to increase the amount of home composting. This reduces the amount of solid waste that is sent to landfills. The United Nation Environmental Program states that on average globally each urban household's solid waste production is made up of up to 30% organic waste (Taking Action, 1996). By increasing the level of home composting the total amount of solid waste produced can be reduced by up to one third. Composting will be encouraged in the San José area with our instructional composting video.

In order to promote home composting through an instructional video we needed to evaluate our audience and the waste management infrastructure currently in place.

This chapter discusses:

- Costa Rica's climate, population, and living conditions;
- Current problems in waste management and composting;
- The science of composting;
- Methods of composting.

Costa Rica's climate, population, and living conditions

Costa Rica is located in Central America bordering the Caribbean Sea and Pacific Ocean. It is between Nicaragua and Panama (Figure 1.1). The Embassy of Costa Rica (n.d.) cites that while the country covers 19,652 square miles, making up .03% of the planet's surface, it yields 6% of the world's biodiversity. This biodiversity includes 0.5 million species of plants and wildlife consisting of 850 different kinds of birds, 600 categories of butterflies, 1200 varieties of orchids, and 237 species of mammals. This unique and vast biodiversity makes proper waste management crucial for environmental protection. The biodiversity plays a large role in attracting tourists. The loss of both this diversity and the abundance of untainted lands would be very damaging to Costa Rica's ecotourism (American University, 1996).

Figure 0.1 Map of Costa Rica (Destination 360, 2007)

The population of Costa Rica is 4.13 million with an annual growth rate of 1.41% (Embassy of Costa Rica, n.d.). The Columbia Encyclopedia (2007) states that if the current rate of growth remains the same, the population of Costa Rica will double in nineteen years. Land will be at a premium as the population grows. Environmental action, like composting, should be taken to protect the untainted land. The Metropolitan Area,

which includes the capital, San José, is occupied by 30% of the total population, but only 1.5% of the national territory (Hall, 2002). This large population density made this area a good target for our project. San José is comprised of mainly urban communities. According to Professor Arrieta, there is limited yard space in San José (personal communication, Nov. 7, 2007). However, most residents have a garden at least two by two meters in size. It is important that the residents of San José have a variety of composting methods for a variety of conditions, including indoors for extreme cases. The composting methods should match the available space and the climate.

The climate in Costa Rica varies from mild in the central highlands, to subtropical in the coastal regions, and tropical in the tropical regions (Embassy of Costa Rica, n.d.). In our area of interest, the temperature generally varies between 60 and 82 degrees Fahrenheit. Costa Rica has a rainy season and dry season. These conditions play a strong role in what food is grown and eaten. The temperature not only affects the solid organic waste that is produced, but the conditions for composting as well. Since there are dry and rainy seasons in Costa Rica, the composter must cover their compost pile with a tarp during the rainy season. The types of foods that typical San José residents consume are beans, corn, rice, meats, plantains, cassava, taro roots, sweet potatoes, cheese, eggs, bread, fresh fruits and vegetables, most of which are ideal for composting (Costa Rica, n.d.).

In order to best address the problems in waste management and composting in Costa Rica, the problems were first fully researched. The next section addresses these problems.

Current Problems in Waste Management and Composting

Waste Management Practices

Currently in Costa Rica, both organic and inorganic waste is transported from homes to the landfill via trucks owned by the municipality, who charge the residents a flat fee of $4 a month. This was reported to us by Professor Arrieta (personal communication, Nov. 7, 2007). Only a few municipalities have a separate collection for recycling; most collect all the waste as one type. According to a *Tico Times* newspaper article by Auriana Koutnik (2005), at best 60% of the waste generated is being disposed of properly. The rest of the waste is brought to open-air dumps, which do not receive environmentally safe treatment. Since the waste is not being handled efficiently by the current waste management groups, the residents of San José could help the environment by recycling their own organic waste.

Current Land Fills

Waste management is a growing concern in the modern world. Immediately prior to the 1992 Earth Summit, 60% of the nations reported to the United Nations that waste disposal were among their biggest environmental concerns (Taking Action, 1996). The San José metropolitan area has a population density of 1,600 people per square kilometer in 2007. This population produces 1,400 tons of waste each day, of which between 30% and 40% goes to open air dumps (Guide, 2003.). San José can be seen in the map in Figure 1.2.

Figure 0.1, Map of the San José area (GoVisit Costa Rica, n.d.)

Until recently, solid waste was disposed of in three landfills in the San José metropolitan area: Rio Azul, La Carpio, and Los Mangos. These can be seen on the map in Figure 1.3.

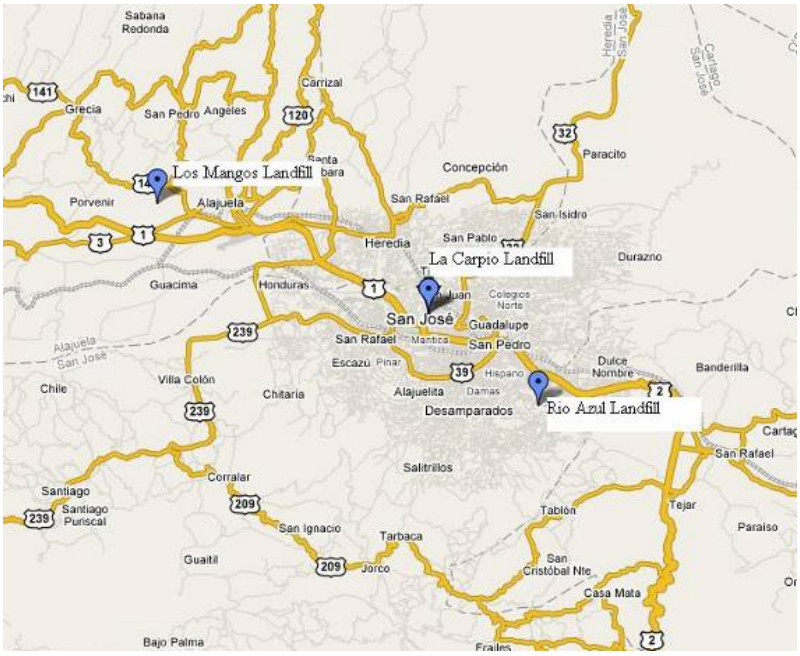

Figure 0.2, Map of Landfill Locations (Google Maps, 2007)

Rio Azul was permanently closed down on July 31, 2007 by the government for sanitary and environmental reasons. The landfill was overused and exhausted. Its four million metric tons of waste were attracting rats, mice, and other rodents which could transmit disease (Mora, n.d.). Rio Azul received 500 tons of waste a day. The landfill was so large and unregulated that after closing, better drainage systems were needed to prevent landslides of the heaps of trash (Hughes, 2007). When Rio Azul first opened in 1973, it was a prime example of how a landfill should be managed in Costa Rica. It ran into financial problems and its quality diminished after a few years (Guide, 2003.). Over the last decade, it has been in the process of closing. It reopened three times during the past ten years for very short periods due to limited space in the area for waste. Rio Azul was so large that its closing resulted in 80 "Buzos" or "Divers" losing their daily jobs of scavenging the trash heaps for recyclables. The "Buzos" simultaneously helped the environment and made money with recyclables (Hughes, 2007). A large part of the problem with Rio Azul was that for 60% of its operation period, the placement of trash was done without any sort of technical criteria (Mora, n.d.). In 1994, Costa Rican President, José Maria Figueres, created a committee called the Executor Unit of the Landfill in an effort to solve the financial and spatial issues of Rio Azul. This committee took over the management of the landfill by subcontracting a company for the treatment

and closure of the landfill. To try and solve the financial issues, the Executor Unit began charging the twelve municipalities that used the landfill by each metric ton deposited. This failed because the municipalities did not fully pay their bills. The fees that were paid did not cover the operation and technical closure of the landfill (Hall, 2002).

After the closer of Rio Azul, solid waste was disposed of in three other locations, the brand new Aserri landfill, the new La Carpio, and the Los Mangos landfill. The Aserri landfill opened on August 15th 2007. The landfill has a daily capacity of 1,000 tons of garbage and is capable of operating for 20 years (Tico Times, 2006). La Carpio is located in the district of La Uraca, Central Canton of San José. Los Mangos is located in Barrio San José in the province of Alajuela (San Jose Metropolitano).

Current and Previous Recycling Programs

According to Professor Arrieta of the University of Costa Rica, a pilot recycling program was started in Santa Ana, a suburb of San José. In this program, the municipality funded and ran a public curbside collection for recyclable materials (Shruti et al, 2002). The "Guide for Economic Sustainability and Quality Life of San Jose" (2003) stated that there are several dozen community recycling projects based on sorting waste at the source. In addition, there is a larger effort where recyclers collect wastes from a variety of sources, including landfills and collection trucks. The results are helpful, but more must be done in order to slow down the amount of waste being created. Further solutions to the waste management problems need to be sought. In 1991, the National Plan for Waste Management identified the following six factors responsible for the lack of recovery of recyclable wastes: incomplete legislation, improper management of solid wastes by the municipalities, lack of institutional policies for the recovery of recyclables, lack of motivation, lack of recycling culture, and non-existing sustainable development policies in the national industry productivity programs. The "Guide for Economic Sustainability and Quality Life of San José" stated that, at the time of its publication in 2003, the first three factors were still valid. However, since 1991, the last three have changed. Recycling culture and motivation have seen great improvements especially due to the work of many non-governmental organizations, informal recyclers, and the

recycling programs of some major companies. This should help encourage people to compost using our video, because people will be more familiar with the idea of composting. If motivation is present then the instructional video could give the residents of the San José area a way to direct their motivation. Existing recycling programs will be complimented by possible composting programs. People that recycle are more likely to be motivated to compost because they better understand the importance.

Waste Management in the United States

There is a wealth of research on waste management in the United State of America. Using this information, one could apply these ideas to composting in Costa Rica. The US environmental protection agency established a hierarchy of waste management. Listed in order of the most acceptable waste management methods, they are: source reduction, recycling (composting) and land filling (Basal Convention, 2007). Composting is the highest form of recycling; it only yields positive byproducts. These beliefs are mirrored by the Basel Convention's policies. The Basel Convention on the Control of Transboundary Movements of Hazardous Waste and their Disposal was formed to address the rising problem of waste disposal, in particular hazardous waste. This worldwide organization was created as a result of countries attempting to dump toxic waste in other countries; they made it a law that countries cannot deliver trash to other nations. The Basel Convention contributes suggestions on recycling with methods such as composting (Basel Convention, 2007).

Bio-solids and yard waste are easy to compost because of their organic nature. The municipal solid waste generated annually is estimated by the US EPA in 1992 to be 73.3 million tons (37.5%) of paper and paper board, 35.0 million tons (17.9%) of yard trimmings, 13.2 million tons (6.7%) of food, and 12.3 million tons (6.3%) of wood (Epstein, 1997). All of these waste products could be composted. Costa Rica's waste percentages may not be the same as in the US, but the methods used to compost this organic waste are. The US EPA predicted that in the year 2000, 189 million tons or 2.05kg per person per day of municipal waste was generated (Epstein, 1997). Since Costa

Rica is only approximately the size of West Virginia, it does not have as much waste as the US. However, the urgency to reduce waste in Costa Rica is much greater than the need in the US, because of the limited space and the fragile ecosystem. Home composting reduces the amount of waste that the landfills must dispose of (Blackwell, 2007).

Potential Future Programs

Organic wastes from kitchens in Costa Rica account for about 60% of the residential solid waste generated (Guide, 2003). However, the "Guide for Economic Sustainability and Quality Life of San Jose" states that, "it is not logical to count on the citizens to make their own compost with their food wastes". This is because the population is constantly growing and the amount of green areas is decreasing. Therefore, there is little space where organic waste can be turned into compost. If done properly, this may be untrue. If the correct composting method is chosen, such as worm composting, then composting could be done indoors; having a yard would not be necessary. If an organization were to buy or collect the soil from the composters then this may create an incentive to compost. The soil could simply be used for personal or communal gardens and the incentive can be that they are helping to save their country. Less waste leads to paying less to get rid of trash at landfills. Professor Arrieta stated that currently there are no community efforts towards composting in the San José area (personal communication, Nov. 7, 2007).

Science of Composting

Goals of Composting

The process of composting involves the decomposition of organic matter. In the case of Costa Rican home composting, waste that is composted includes paper, yard waste, and foods such as rice, beans, coffee, and fruit scraps. The goal of composting is to disinfect and decompose the waste, in order to produce a humic substance that is used for soil improvement. A humic substance is similar to soil in its appearance, but is richer in nutrients (Blackwell, 2007). It is useful for small gardens or to sell to farms. Composting is more economically favorable and more environmentally friendly than the alternative of sending the organic waste to a landfill (Shell, 2005). This is particularly significant for Costa Rica because of its fragile ecosystem. This is a better alternative then putting waste in garbage bins on the street. One reason is that rodents tear trash bags open on the street, spilling organic, and inorganic matter. If the organic waste was being composted it would decrease the amount of waste on the streets. A second reason why this is a good alternative is that it would produce less waste for the overcrowded landfills.

Soil Conditioner

Compost is beneficial to home gardens and therefore could benefit Costa Ricans living in suburban areas or Costa Ricans using a communal garden. Compost is often referred to as a soil conditioner (Shell, 2005). It improves soil's physical properties and plays a role in plant productivity. Plants could better handle drought when fertilized with compost. It also helps with root development and nutrients. This makes the gardening process much easier and the plants much healthier. Compost is capable of significant water retention, which is especially important in Costa Rica because of the dry season.

The particles in compost tend to be fairly large compared to soil, which allows it to hold water better (Epstein, 1997). Sands and clays especially benefit from compost and

its ability to irrigate the soil (Blackwell, 2007). This is useful in Costa Rica when it is not the rainy season. The plants need to be watered less frequently when using a compost product. Figure 2.1 below shows the healthier and more extensive root system of the plant grown in soil conditioned with compost.

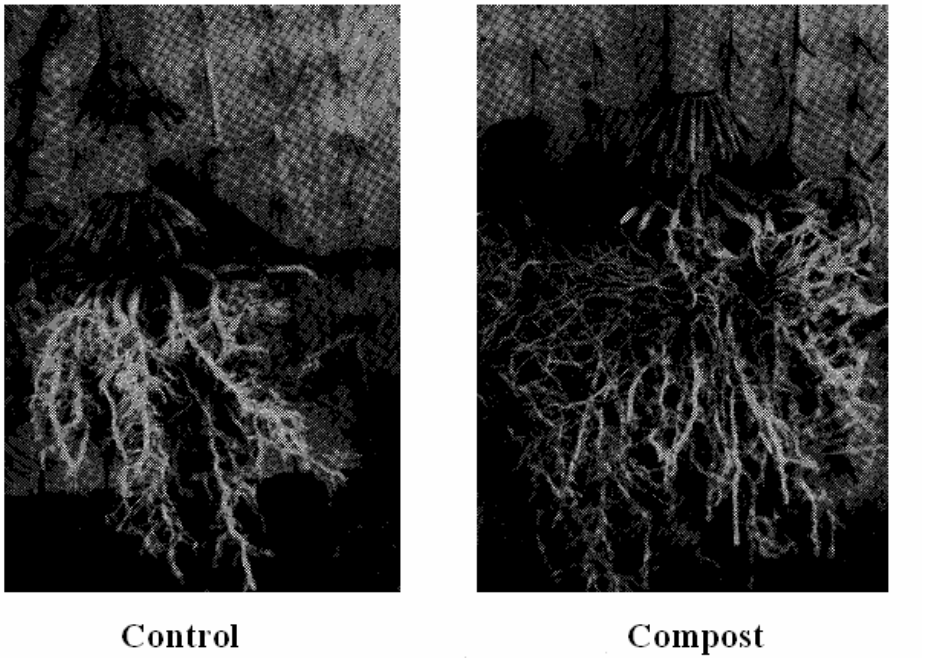

Figure 0.3. Effect of Compost on Corn Root Development (Epstein, 1997)

The large particles in compost help the roots to grow more freely and take a better hold in the soil. Figure 2.2 below compares a control and compost-amended corn leaf during a drought. The corn leaf to the right is of a corn plant that is grown in compost-amended soil and the leaf on the left is the control whose soil has been untouched. The plant that is grown in the compost-amended soil is healthier which will result in a larger crop yield (Epstein, 1997). In the rainy season the large soil particles will even help drain the water. Otherwise if the soil is too compact it can cause flooding and soil saturation.

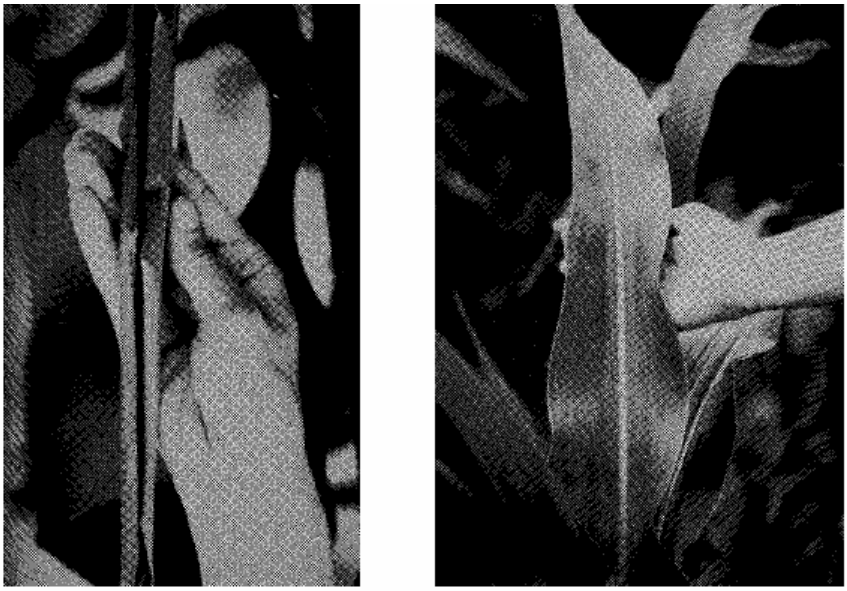

Figure 0.4. Corn Leaf Fertilized Control Plot During Drought (left); Corn Leaf from Compost-amended Soil During Drought (right) (Epstein, 1997)

Contents of Compost

There are the two organic wastes that should be left out of the compost pile. Composting meat should be avoided because substances found in meat such as cellulose and lignins are difficult to degrade and they take an extended period of time to decompose (Epstein, 1997). Along with meat, mineral matter should not be composted since it does not degrade in composting (Blackwell, 2007). Most foods are comprised of carbohydrates, sugars, proteins, and fats that are easily decomposed. The items that can be composted are things such as egg shells, grass, leaves, paper, fruit, and coffee grounds.

Temperature and Rate of Decomposition

In Costa Rica, the surrounding temperature for composting is controlled by the weather or the indoor temperature. The surrounding temperature affects the kinds and

amounts of organisms present. Most literature argues that the optimal temperature for composting is between 50-60ºC (122-140ºF) (Epstein, 1997). Studies from Wiley and Pierce (1955), Schultz (1961), and Regan and Jeris (1970) show that the maximum amount of carbon dioxide is produced at 60-65ºC (140-149ºF), the maximum rate of decomposition _ccurs at 65-70ºC (145-158ºF), and the maximum oxygen uptake is at 45-60ºC (113-140ºF) (Epstein, 1997). Oxygen use is a function of microbial activity; therefore, the temperature at which the oxygen uptake rate is highest is the optimum decomposition rate (Blackwell, 2007). In Costa Rica, the temperature ranges from approximately 15.6 to 26.7ºC (60-80ºF), so the compost could not react at its maximum rate. However this would not severely affect the compost; it merely extends the amount of time that the compost takes to mature. It should take between six to eight weeks for the compost to reach completion in Costa Rica (Blackwell, 2007). The amount of time that it takes to mature does not depend on the quantity. This is important because it gives an estimated time frame that the Costa Ricans should test to see if their compost has matured. Once it has matured, the soil can be put in gardens or used for potted plants.

Internal compost temperature is a result of the microbial respiration (Shell, 2005). The temperature correlates with factors such as moisture content increase, the loss of oxygen, and the increase of carbon dioxide (Shell, 2005). It is important to maintain moisture or the process stops. There is too much water if you squeeze the compost and water comes out; one or two drops of water are acceptable. If it rains for more than three days, the pile should be covered (Blackwell, 2007). It is vital to do this during Costa Rica's rainy season. When the compost pile is kept moist, the temperature feels like body temperature. Temperature not only plays a role in the composting process, but is also a function of the process.

Importance of Balancing the Carbon and Nitrogen Levels of the Compost Pile

The carbon © and nitrogen (N) levels in the compost's reactants must be balanced in order for maximum microbial growth and activity (Blackwell, 2007). It is expected

that the people who will be composting in the San José region of Costa Rica will not be critically monitoring the amount of carbon and nitrogen in compost because it is a detailed process. It is possible to estimate and roughly balance the ratio to keep an approximation on the correct levels of each. In composting about 25-30 parts carbon are needed for one part nitrogen (A Guide to Backyard Composting Ingredients, 2005). The way to insure good levels of carbon and nitrogen in the compost is to blend different materials. Items that have high levels of carbon are considered browns and materials with high levels of nitrogen are considered greens. For example, leaves have 80 parts carbon to one part nitrogen, whereas grass has high levels of nitrogen (Shell, 2005). In Costa Rica, some items that can be used as browns are corncobs, cornstalks, newsprint, straw, hay, shrub trimmings, wood chips, and paper. Good greens to use are alfalfa, coffee grounds, crab/fish waste, fruit, vegetables, and manure (with the exception of human, cat, and dog waste) (Shell, 2005). Organic waste is used by microorganisms as a source of carbon and nitrogen (A Guide to Backyard Composting Ingredients, 2005). When the green levels are too high, microorganisms produce ammonia, which reduces the compost's value as a fertilizer (A Guide to Backyard Composting Ingredients, 2005). If there are not enough greens, the cells begin to grow rapidly and the composting process slows (A Guide to Backyard Composting Ingredients, 2005). As a result of the rapid growth, the amount of nitrogen is quickly depleted and the cellular growth stops. A problem that Costa Ricans might face is having too many greens, because of their regular consumption of coffee, fruit, and vegetables. This can be balanced out by adding more browns such as leaves or paper products.

For people composting in Costa Rica, if the amount of nitrogen is too much or too little, it increases the amount of time needed to compost or reduce the composts effectiveness as a fertilizer. Fertilization properties will only affect people who plan to use or sell the compost product for gardening. Since the compost is most likely to be used for gardening, the nitrogen levels should be observed.

Organisms Involved in Composting

The organisms present in compost that are needed to break the waste into usable soil are found in the surrounding environment. They do not need to be bought or produced. Organisms that are associated with composting fall into three groups: cryophiles (psychrophiles), mesophiles, and thermophiles (Shell, 2005). The organisms that are present in Costa Rica compost are cryophiles and mesophiles. This is because different bacteria have different optimal growth temperatures. As temperature increases, the growth rate of the organism increases (Shell, 2005). This is beneficial, because the organisms help break down the organic matter. The microbial population fluctuates during the composting process. This is shown in figure 2.3 below. The amount of time that passes correlates with the amount of organisms present. The most amount of organisms are generally present between five to twenty days (Epstein, 1997). If you mix the greens and the browns with the correct amount of moisture, the most microbial activity will occur between these days, and the rate of decomposition will be greatest.

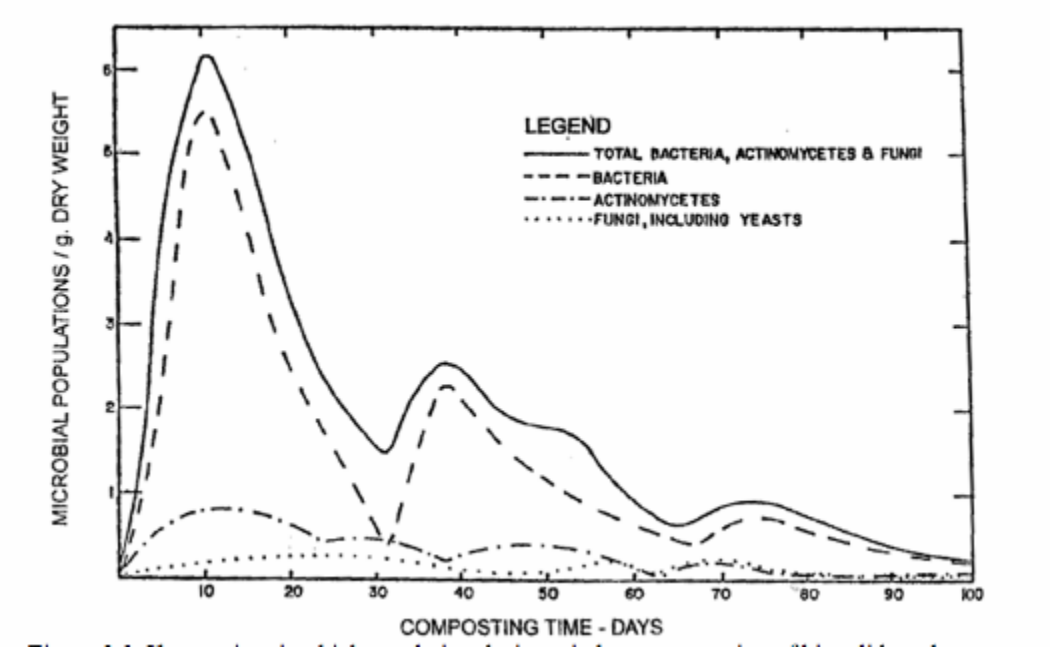

Figure 0.5. Changes in Microbial Population During Windrow Composting of Biosolids and Bark. (Epstein, 1997)

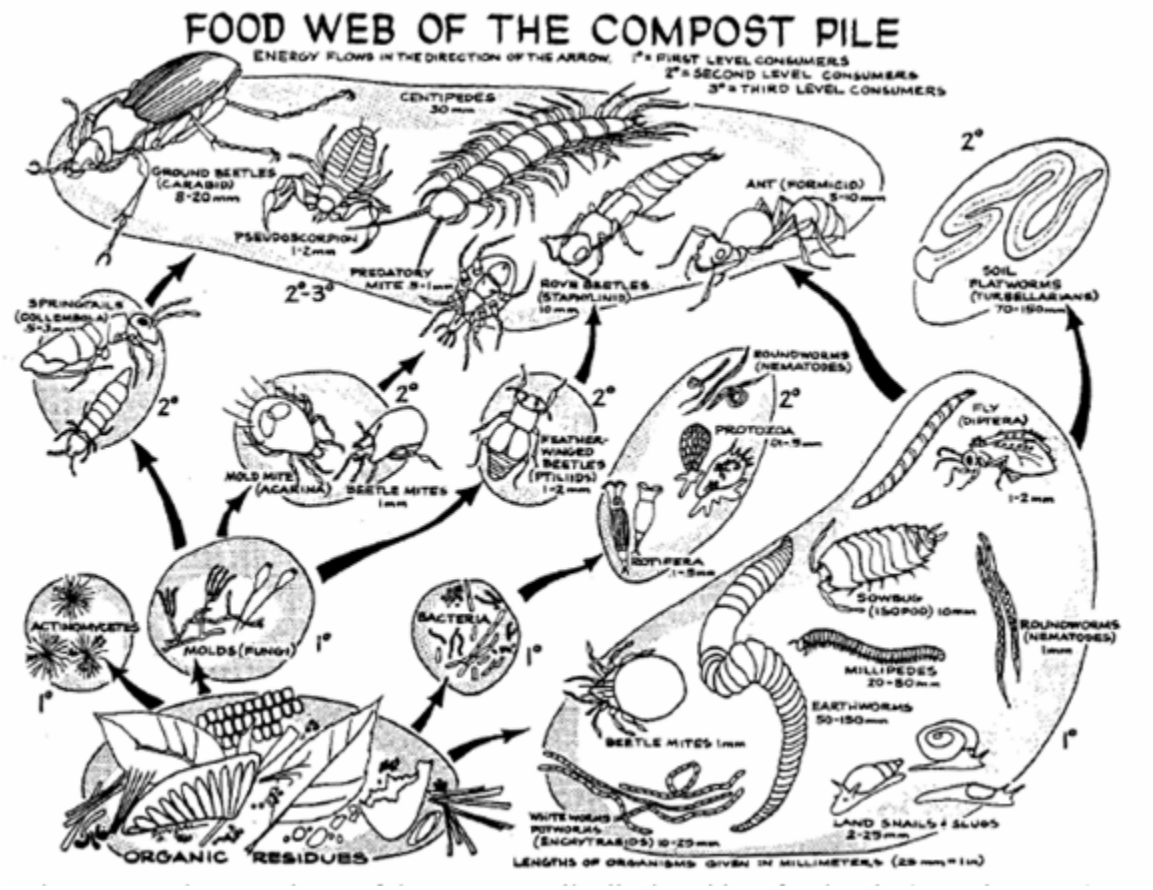

Figure 0.6. The Organisms of the Compost Pile Displayed in a Food Web (Epstein, 1997)

A variety of organisms are needed to decompose waste. Bacteria, molds, and actinomycetes feed other soil dwellers (Epstein, 1997). Figure 2.4 gives a view of the food web that is present in compost. All of these organisms help with the stages of the compost before the compost reaches maturity (Epstein, 1997).

Maturity of Compost

The maturity of compost can be determined in a myriad of ways. All of the processes that occur in the compost pile are related. Tests such as, smell, sight, compost product (humic substance), C to N ratios, oxygen/ carbon dioxide, or temperature can be used as a guide (A Guide to Backyard Composting Ingredients, 2005). Figure 2.5 shows the relationship between the components of composting.

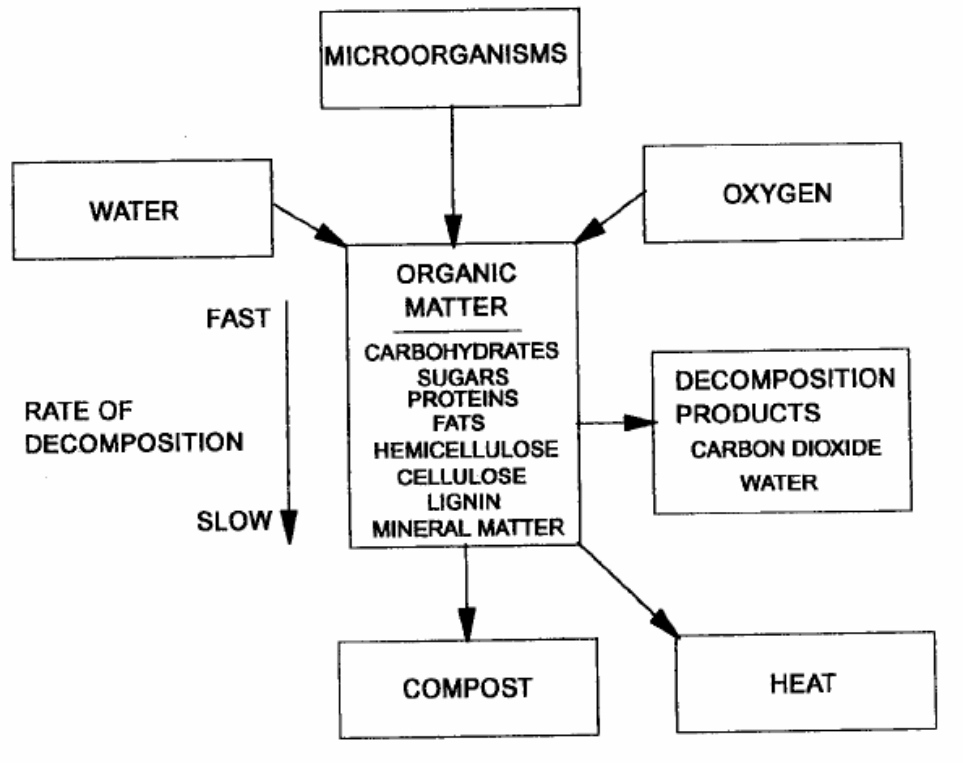

Figure 0.7. The Composting Process (Epstein, 2007)

People in Costa Rica can easily decide if the compost is mature through smell and sight. The amount of time that compost takes to stabilize depends on the components of the compost. A simple, but subjective physical test is smell. Mature soil should smell like forest soil (Epstein, 1997). This smell is due to actinomycetes (Epstein, 1997).

A second indicator is determining the amount of humic substance. If the compost resembles a dirt-like substance (humic substance) then the process is complete (Blackwell, 2007). There should be no sticks or twigs remaining. Nothing in the humic substance should be discernable. Figure 2.6 compares the amount of paper to the amount of humic substance. The humic substance is the darker color and the paper is the lighter. After eighteen days of composting, more than half of the original paper has become a humic substance (Epstein, 1997). This is an example of the visible change as well as the speed at which the change can occur. Inbar (1989) reported that humic material grew rapidly in the first 60 days and from 60-140 days there was little growth (Epstein, 1997).

Sight and smell are the best methods for the Costa Ricans to determine if the compost pile has gone to completion.

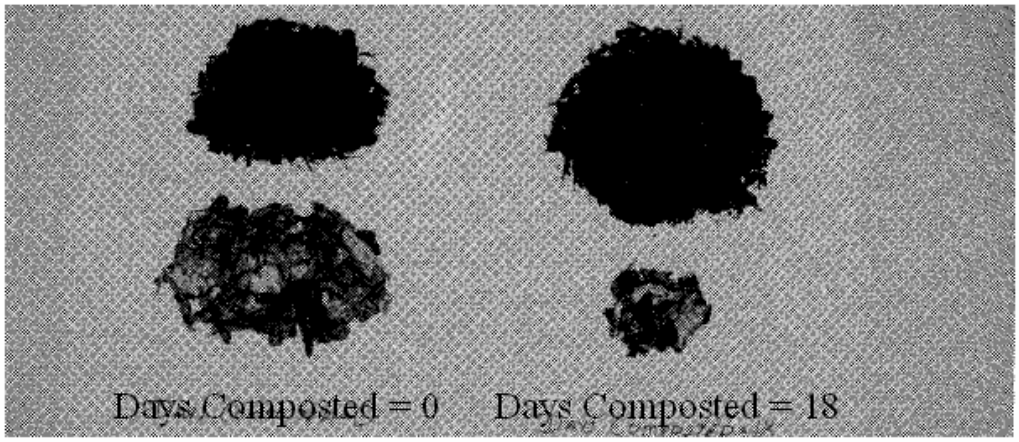

Figure 0.8, Decomposition of Paper During Composting with Yard Waste and Nitrogen (Epstein, 2007)

Chemical methods, physical methods, and microbiological test are accurate ways of determining the maturity of a compost pile. Often compost is considered mature when it can be stored in piles without becoming anaerobic (Gea, 2004). This is an unpractical method for Costa Ricans unless they have an oxygen analyzer. Low carbon to nitrogen ratios are a good gauge for the maturity of compost. The compost is assumed to be stable when the C to N ratio is below 20 (Blackwell, 2007). This is difficult for Costa Rican home and apartment owners to measure. It is more appropriate for waste management sites or if composting is being done on a larger scale. One of the products produced by the microorganisms is carbon dioxide. The measurement of carbon dioxide levels can also reveal the maturity of the compost (Gea, 2004). Chemical methods are some of the most accurate methods, yet they are difficult to determine without costly tests. Therefore this is the least practical method of determining compost maturity for Costa Ricans.

The temperature affects the rate of decomposition (Trautmann, 1996). Therefore it can be used as an indicator as to the stability of the compost. Temperature correlates with the chemical processes that are occurring. Monitoring the temperature is a good solution when the chemical tests are not practical. Figure 2.7 shows the correlation. The temperature is not difficult to monitor, however, it can be time consuming to continually

check. The temperature of the waste can be taken by inserting a thermometer into the compost. Compost thermometers can be purchased at gardening stores (Blackwell, 2007). Since most do not want to have to take the temperature of their compost pile on a daily basis, it is best for the Costa Ricans to feel it by hand. If it feels about the same temperature as the ground, then it is ready to be used for planting.

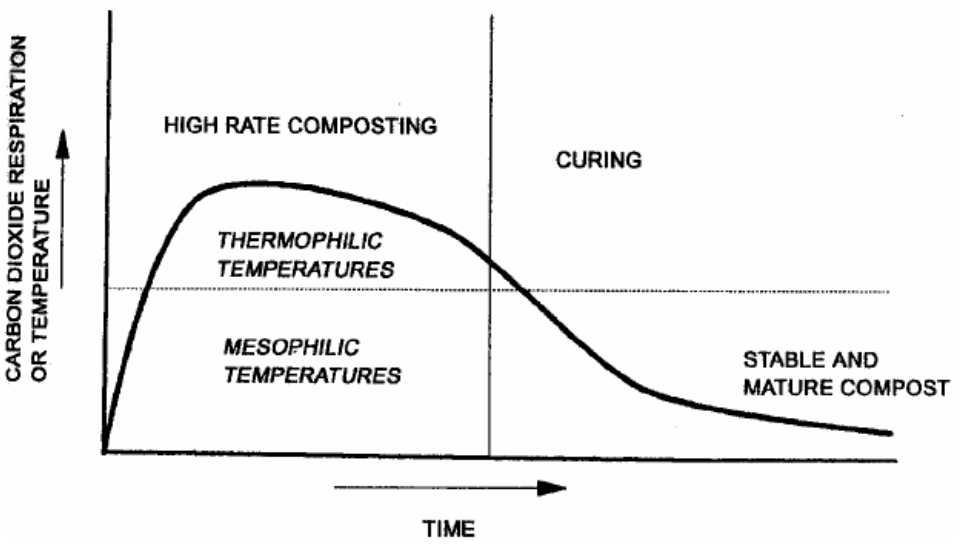

Figure 0.9, Phases During Composting as Related to Carbon Dioxide Respiration and Temperature (Epstein, 2007).

Since this is an aerobic process, oxygen is essential for microbial activity (Gea, 2004). This is why it is important to physically turn the compost mass and mechanically aerate (Epstein, 1997). The method of aeration is known as curing. One can use a shovel, pitchfork or gardening tools specifically made for this purpose. Figure 2.8 shows how quickly oxygen is used. Curing should be preformed when the soil is between 80 and 100 degrees Fahrenheit (Blackwell, 2007). A simple way to determine if the compost is at this temperature is feeling the compost to check if it is about body temperature. The more days that have progressed in the composting process, the less oxygen will be used (Gea, 2004). Without oxygen, anaerobic conditions will cause offensive odors. A simple way for Costa Ricans to eliminate this is by curing the compost.

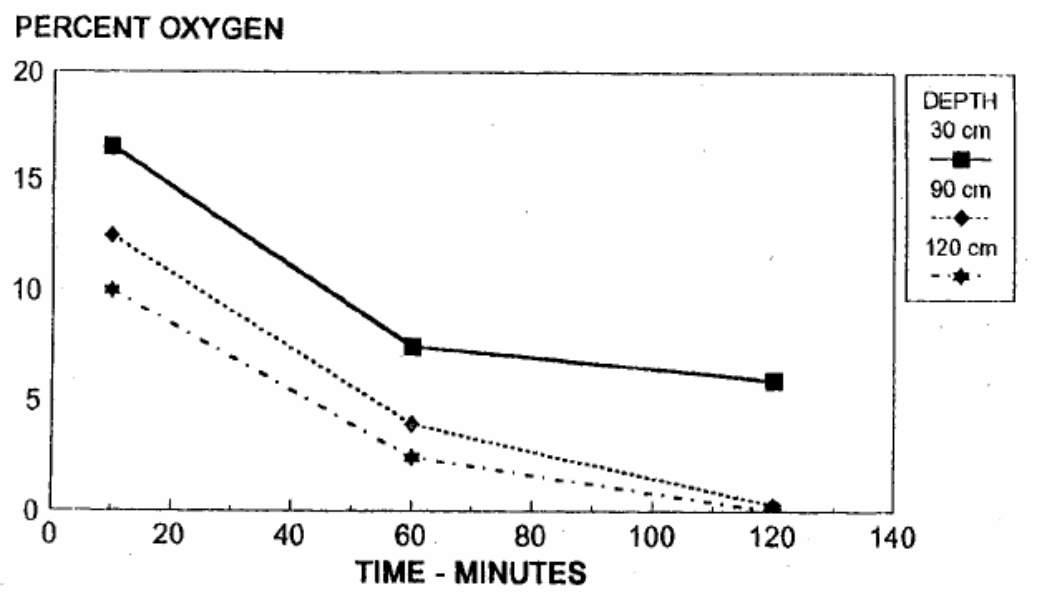

Figure 0.10. Oxygen Depletion in a Yard Waste Windrow Following Turning. (Epstein, 2007)

Dangers of Composting

Compost should not be ingested. It is important to prevent the human intake of pathogens that are present during the composting process (Epstein, 1997). This can be avoided by washing hands and not ingesting any of the material. The primary pathogens found in waste and compost is bacteria, enteric viruses, protozoa, and helminthes (round worms and tapeworms) (Epstein, 1997). These can be harmful to humans.

Indoor composting is unsafe for people living and working under the same roof. When working and composting indoors, ventilation precautions must be taken. Bioaerosols can be produced from compost. Bioaerosols are airborne biological elements that effect human health (Epstein, 1997). Inhalation of dust from composting can cause inflammation, allergy, and infection. The dust can contain living and nonliving agents (Epstein, 1997). The fungus, *Aspergillus fumigates*, is concerning because it can survive at different heat levels. It causes an acute chronic inflammatory infection in the respiratory track and occasionally other tissue. This condition is called Aspergillosis (Epstein, 1997). Composting should not be done indoors unless necessary; when composting indoors, masks should be worn for protection.

Composting with worms, also known as vermicomposting, is the only safe method of indoor composting (Composting with Worms???, 2004). This method does not produce harmful pathogens, although the substances still should not be ingested (Composting with Worms???, 2004). Costa Ricans can put a small bin of compost with worms in their homes without worrying about pathogens.

Materials and Methods of Composting

Ingredients

Brown materials are high in carbon and consist mostly of dead leaves and branches, although paper products such as newspaper or torn up cardboard can be used as well. Green materials are high in nitrogen and include food scraps, vegetable peels, and coffee grounds (Environmental Protection Agency [EPA], 2007). Table 3.1 shows materials that are good to use and whether they are brown or green.

Table 0.1. Material used in composting. (Massachusetts Department of Environmental Protection, 2007)

High Nitrogen "Green" Ingredients	High Carbon "Brown" Ingredients
grass clippings	autumn leaves
Weeds	straw
food wastes: fruit & vegetables, coffee grounds, tea bags, egg shells	paper towels, napkins, paper bags, plates, coffee filters, tissue and newspaper
manure (cow, horse, chicken, rabbit)	cornstalks
seaweed	wood chips, saw dust
alfalfa hay/meal	pine needles

There are some things that should never be put into a compost pile. Meat and fish bones or scraps will cause odor, which will attract rodents or insects. Dairy products will do the same thing. Dog or cat wastes may contain organisms that are harmful to humans, and so should not be added to the compost pile. Any yard trimmings that are treated with pesticides could kill organisms that are beneficial to the composting process (Environmental Protection Agency [EPA], 2007). Table 3.2 shows materials that should not be used in composting and why.

Table 0.2. Materials not to use in composting. (Environmental Protection Agency, 2007)

What Not to Compost

• Coal or charcoal ash
  • Might contain substances harmful to plants
• Dairy products (e.g., butter, egg yolks, milk, sour cream, yogurt)
  • Create odor problems and attract pests such as rodents and flies

• Diseased or insect-ridden plants   • Diseases or insects might survive and be transferred back to other plants
• Fats, grease, lard, oils, or foods cooked with such ingredients   • Create odor problems and attract pests such as rodents and flies
• Meat or fish bones and scraps   • Create odor problems and attract pests such as rodents and flies
• Pet wastes (e.g., dog or cat feces, soiled cat litter)   • Might contain parasites, bacteria, germs, pathogens, and viruses harmful to humans
• Yard trimmings treated with chemical pesticides   • Might kill beneficial composting organisms

General Composting Tips

A compost pile can be defined as the materials combined to make compost. Compost cannot be made without some sort of pile, because the pile is where the composting happens. A pile can be meticulously layered in order to speed up the composting process or the composting materials can be combined haphazardly for slower composting. It is up to the composter to decide the amount of effort to put into the pile.

One common way to begin a pile is by layering the different types of materials. This helps the pile to begin the composting process quicker. The ground under the pile (or the bottom of the bin in which the compost is being made) must be moist. This will help retain the moisture in the compost pile. If the pile becomes too dry, the organisms will not be able to survive and composting will not take place. The first layer of the pile should consist of about four inches of browns. It will help the pile if these browns are a little bulkier than usual. This will bring better aeration into the pile (Hursh, Olenick, & Wycheck, 2003).

Hursch, Olenick, & Wycheck next recommend that composters layer in the following way: add two to three inches of greens on top of the browns, watering them thoroughly. It is important to keep the compost pile constantly moist. On top of the greens, add a thin layer of soil. Compost that has already been made can also be used for this soil. This will increase the amount of organisms initially present in the pile. After the soil, another four to five inch layer of browns is added, and watered again. After this, alternating layers of greens (two to three inches) and browns (four to five inches) should be applied, watering every layer. The final layer of the pile should be browns and on top of that another thin layer of soil. While this is the optimal method to get the composting process started as soon as possible, it is not necessary. Lumping all of the materials will work too, but it may take longer to begin. It is also possible to add to the pile over a period of time. The composter can add food scraps every day. The composter may choose to keep them separate and add each week. If the composter chooses to add food scraps daily or weekly, they should mix in the new food scraps with the rest of the pile, as opposed to just laying them on top (Hursh, Olenick, & Wycheck, 2003).

The time it takes for the pile to become actual compost depends on how much care is given to the pile. If the pile is left alone after the initial setup, it can take over a year to finish. If the pile is turned or aerated weekly, the time can be cut down to several months. If the pile is turned every two or three days, it may be completely composted within just a few weeks (Hursh, Olenick, & Wycheck, 2003).

Garbage Can Bin

There are many different methods that can be used for composting, such as the garbage can, the wire mesh, or the six-hole method. Many factors should be considered when choosing the best method to use. Some are compact, while others take up more space; some require frequent turning of the materials, while others do not need any. Many composting piles are made on the ground, but some are made in special bins used to speed up the process. These are only a few of the factors that must be considered.

Creating compost in a modified garbage can is easy and inexpensive. Garbage can bins do not take up a lot of space and are ideal for keeping away rodents, which is a concern in an urban area such as San José. This method is best for residents with small yards. The only material needed for this method is a heavy duty plastic garbage can, approximately 30-40 gallons in size, with a locking lid. If the lid of the can does not lock, another way must be found to secure it shut in order to keep out rodents (Noyes, 1995).

The composter should drill ¼ to ½ holes around the sides and bottom of the can. This helps with aeration and drainage, but the holes are not large enough to let out a substantial amount of waste (Hursh, Olenick, & Wycheck, 2003). The can should be placed on top of bricks, so that excess moisture can be drained (Noyes, 1995). An example of a garbage can bin is shown in Figure 3.1. The composter should layer the materials in the can the same way as previously described, but put a layer of soil in between each layer of greens and browns. Garbage can bins usually retain moisture well, but more water may be needed at times (Noyes, 1995). These types of bins should be mixed slightly more regularly than others; the aeration for this bin is not as good as most others and the system has a good chance of becoming anaerobic, leading to odors. An easy way to mix the materials in this bin is to make sure the lid is securely fastened and

to turn the bin on its side and roll it. The composted materials should fall out of the small holes, so that it can be collected. Using this method may take several months to create usable compost (Hursh, Olenick, & Wycheck, 2003).

Figure 0.11. A Garbage Can Composting Bin (Pennsylvania Department of Environmental Protection, 2007)

Wire Mesh Composting Bin

A bin made of wire mesh is another compact and inexpensive bin to make. It is much messier than the garbage can bin and it allows for the possibility of rodents to get in, but the time it takes to create usable compost is much shorter. Because of the mess, this method should be used by homeowners with a larger yard. The materials needed for this bin are 12-13 feet of 36 inch wide medium grade wire mesh, 3-4 pieces of wire, and 3-4 metal or wooden stakes. The composter should form the wire mesh into a circle, with the ends joined at the top, bottom and middle with the wire. The stakes should be placed around the inner edge of the mesh and hammered into the ground. This is all the setup that is needed and composting materials can be layered inside the bin as usual (Hursh, Olenick, & Wycheck, 2003). Figure 3.2 shows an example of a wire mesh composting bin.

Figure 0.12. A Wire Mesh Composting Bin. (Organic Gardening from Down Under, 2007)

The open sides of the wire mesh provide a great deal of aeration to the pile, but moisture is quickly lost for the same reason, so this bin must be watered regularly. It may be necessary to cover the bin with a tarp or some other covering in order to prevent rain from drowning the pile; if the pile becomes too wet it will not work. About a week after adding the materials, they should be turned. A convenient way to mix the materials in this bin is to completely lift the bin off the ground, letting all the materials fall out the bottom. The bin can then be moved to another location and refilled with the materials. If properly maintained, a wire mesh bin can provide usable compost in as little as 15 days (Hursh, Olenick, & Wycheck, 2003).

Six-Hole Method

If the main goal of the composter is not to create high quality compost, but only to recycle as much food as possible, the six-hole method should be used. This six-hole method is inconspicuous and fast. The quality of the compost it produces is not high, but the speed with which it produces the compost is great. Professor Arietta recommends that the composter dig a hole about two feet wide and one foot deep (personal communication, Nov. 7, 2007). After the hole is dug; the materials should be layered in, with soil being added between each layer. This soil should come from a second composting hole dug near the first one. The composter should cover the top of the hole with soil, leveling it with the ground. Once the first hole is full, the second hole can be started, mixing with soil from a third hole, and so on. These holes should be turned and mixed frequently, to avoid odor (Noyes, 1995). These holes can be filled quickly with organic waste and usually by the time a sixth hole is dug the first hole is finished the composting process. Professor Arietta suggests that an attempt be made to protect these holes from rain, as they could easily become oversaturated with water (Personal Communication, Nov. 7, 2007). One method of protecting the holes from rain is putting the holes on raised ground and then placing a tarp over the holes when it rains.

Worm Composting

If composting outdoors is not an option, an indoor alternative is worm composting, also known as vermicomposting. Worm composting is sanitary and odorless, making it perfect for indoors. Regular earthworms cannot be used for this method, as they require a large amount of soil to survive. Worm composting requires either Red Wigglers (*Lumbricus rubellus*) or Brandling Worms (*Eisenia foetida*) (Worm Composting Tips, 2007). These worms thrive in bacteria rich environments, such as a compost pile. These specific worms reproduce quickly, essentially creating a never ending supply of worms

within the bin. These worms can be found at a fishing supply store or ordered online (Hursh, Olenick, & Wycheck, 2003).

Any type of plastic storage container with a lockable lid works for worm composting. Usually a five or ten gallon storage bin is most convenient. The composter should drill a few holes along the top of the bin to give the worms air. The worms need bedding to create a healthy environment. Moist shredded newspaper and cardboard work best. The bin should be filled about halfway with bedding, without compacting it too much. The worms should then be added on top of the bedding (Worm Composting Tips, 2007). About one pound of worms (approximately 1000 red wigglers) should be used to start (Red Worm Composting, 2007).

Every pound of worms in the bin could eat a pound of food about every two to three days (Worm Composting Tips, 2007). Worms eat the same things that would normally be added to a compost pile. For worm composting, there is no need to separate browns from greens. Scraps to be added are placed on the bottom of the bin; this way the worms eat it faster before it attracts fruit flies. Citrus peels or scraps should not be added to the bin; this raises the pH and negatively affects the worms. It is necessary to add soil or coarse sand monthly, on top of the weekly food scraps, in order to keep the worm's digestive tract healthy (Hursh, Olenick, & Wycheck, 2003).

The output from worm compost is not the same as a traditional composting bin or pile. The usable final material is not compost at all, but worm castings. These castings are rich in nutrients and organisms. They should be harvested approximately every three months or when the worm's bedding starts to get too low. To collect them, the composter should remove all of the excess bedding, being careful not to crush any worms. The castings are at the bottom of the bin; they should be removed and placed in a separate container. The composter should add the removed bedding back into the bin and add in enough new bedding to fill the bin halfway as before (Hursh, Olenick, & Wycheck, 2003). The worm castings can be used in any of the same capacities as traditional compost, but since the volume of castings produced is much smaller, it is best to apply them to the soil of small potted plants (Hursh, Olenick, & Wycheck, 2003).

Assessing the Feasibility of Different Composting Methods

Choosing the right composting method is simply a matter of weighing the pros and cons. The garbage can bin is neat and easy, but it takes a long time to produce usable compost. The wire mesh bin is very quick, but it is also messy. The methods are summarized in Table 3.3.

Table 0.3. Pros and cons of the different composting methods.

	Pros	**Cons**	**Suggested User**
Garbage Can Bin	Compact and clean. Easy to make bin. Keeps away rodents Can keep under roof in rainy season	Takes a long time to create usable compost	Homeowner with a small backyard, who is in no rush to get compost
Wire Mesh Bin	Quick and easy	Messy, and may attract rodents	Homeowner with a larger backyard, who wants compost quickly
Six-hole Method	Underground and quick. Keeps away rodents	Compost is low quality. Difficult to cover with a tarp in the rainy season.	Homeowner who wants to recycle, but does not care about quality of compost.
Vermicomposting	Can be done indoors.	Does not produce a large volume of castings	Homeowner without a yard

Potential Uses for Composting in San José

By composting people are able to create nutrient rich soil to enrich any preexisting soil. Margaret Hagen at the University of New Hampshire (2000) states that

using finished compost is a way of returning organic matter to the soil in a finished form. Hagen cites that adding compost to soil "benefits plant growth by improving the moisture and nutrient-holding capacity of sandy soils, by helping aerate and loosen heavy clay soils, by adding essential plant nutrients in to the soil and helping prevent soil erosion" (1). She lists four different ways that compost could be used: soil amendment, potting mix, mulch, and lawn top-dressing. Soil amendment involves spreading a layer of compost, up to three inches thick, on a soil surface. This layer is then worked into the top six inches of soil when preparing the soil bed for planting. Potting mix for indoor or outdoor grown plants is created by mixing one part compost, one part coarse sand, perlite, or vermiculite, and two parts topsoil. Compost can be used as mulch by spreading two to six inches around the base of plants to help retain moisture, keep weeds down, prevent soil compaction, and reduce soil temperature fluctuation. Compost can be used as a lawn top-dressing by sifting it through one-half inch mesh hardware cloth and applying so that grass plants are not completely covered. These different methods illustrate the broad range of uses for compost. The residents of San José could use the soil for their own personal gardens or potted plants. If they do not have personal gardens or potted plants, a solution is needed. These solutions could include a communal garden that may already exist or the soil could be used for public gardens. If these solutions are not a possibility, local farms or the agricultural department could have a use for the compost. Entrepreneurs can pick up compost for resale. Professor Arrieta stated that because nearly every resident has a garden or indoor potted plants, they can use some compost for those (personal communication, Nov. 7, 2007).

CHAPTER 3: METHODS

Audience Analysis

According to Professor Ronald Arrieta, the reason that the residents of the San José area are not composting is due to a lack of education on the importance of composting and the methods of composting. The purpose of our instructional video is to educate residents of the San José area on these topics. For the video to appeal to the San José audience, we needed to consider who the audience was. We learned what their motivations to compost are, and what resources are available to them for composting.

The audience for this video will be residents of the San José area in Costa Rica. Professor Arrieta had requested that the video be suitable for a broad audience, including young adults, adults, homeowners, and anyone else living in the San José area that had an interest in composting. Professor Arrieta envisioned this video being watched on an individual basis and in classrooms at schools (personal communication, Nov. 7, 2007). The video needed to be a standalone video that was able to be shown to a large group of people with little work required on the part of the presenter. A viewer at home using the video as a resource needed to be able to quickly access specific information that he or she required. These two different audiences needed to be kept in mind while designing the instructional video.

A potential issue was the language barrier. Professor Arrieta told us that we could create the video fully in English and if any translations were necessary, his graduate students would translate. It was important to keep the language in the video as direct and simple as possible for translation purposes. Because of this, we decided to demonstrate with visuals as much as possible.

The resources available to our audience needed to be considered. While the San José area was an urban area, Professor Arrieta had stated that many residents have a garden at least two by two meters (6.5 feet by 6.5 feet) large, or a small yard (Hall, 2002). We planned on a large percentage of our audience composting in their own garden. We

assumed that the residents had access to basic materials that one could find at a local hardware store.

To ensure that the video reached the greatest number of residents, it needed to be available in a commonly accessible medium. Our project team and Professor Arrieta agreed that a DVD format would be most readily viewable for the audience. It allowed for the most flexibility in producing and watching the video. Professor Arrieta stated that the DVD format would be the "most common and comfortable." Unlike a VHS, a DVD would allow the users to navigate a series of menus, so that they might quickly access the content that they want. A DVD also would allow the content to be watched in sequence as if it were a VHS. These aspects of a DVD were important for our divided audience of individual home viewers and classroom viewers.

Professor Arrieta will be responsible for distributing the video. The various ways he will do so may include providing copies at the local library. He may show it to students in the local schools or make it available on the internet. He may give it to people through requests or possibly have the entire video on a website.

To make the video successful it needed to be applicable to the largest number of people possible. We explained four different composting methods, so that residents with different resources and needs could compost in the way that best suits them. There are four factors to consider when choosing the right method. The first is the size of the yard that the person composting has to work with. Different methods require different amounts of space. The second is how quickly the organic waste becomes compost. Some people may want more immediate results than others. The third factor is the amount of work required to produce the compost. Some methods require little initial setup and maintenance, while others are much more involved. The last factor is the quality of the compost produced. Some may only want to use the compost for their lawn and do not need quality compost, while others want better quality compost if they plan on using the compost for their gardens.

One method of composting that is discussed in our video is the six-hole method. This method was suggested by our sponsor. It is effective for those with larger backyards that want their final compost product sooner, and are willing to put in a moderate level of

effort. It does not produce high quality compost, and is therefore suited to those only trying to dispose of their organic waste.

The garbage can method can be done anywhere outside, so is well suited to those with a small backyard. This method takes longer than the six-hole method. It requires less work then the six-hole method, but is not maintenance free. The quality of the compost is much better than the six-hole method, but not the best.

The wire mesh method requires the largest size yard and takes the same amount of time to compost as the garbage can method. It also requires more work, but produces the greatest quality compost. This method is ideal for those with a larger yard that have the time and motivation to create quality compost.

Worm composting is good for those with no yard. Worm composting is the only method that can safely be done indoors. It is slower than the other methods, and requires more work, but the quality of the compost is very high. This method is ideal for those that cannot compost outdoors, but still want to properly dispose of organic waste.

Instructional Methods and Theory for Writing and Design

In order to learn about and decide which writing and design techniques to use, we reviewed three texts on instructional writing: *Technical Communication in the Global Community* by D.C. Andrews, *Technical Writing* by J.M. Lannon, and *Dynamics in Document Design* by K.A. Schriver. We also viewed a series of instructional videos provided by the WPI Academic Technologies Center. These videos showed us how the writing techniques could be applied to a visual medium.

K.A. Schriver (1997) reported that in order to get the audience's attention, a document must look attractive. Getting the audience's interest and making sure that they understand the lesson is the key to a successful instructional tool. In order to gain and maintain the audience's interest, we needed to take into account the structure and design of the video. The design included color coordination, font, images, and organization. We used colorful and meaningful backgrounds for our title pages and menus in order to appeal to the audience.

K.A. Schriver (1997) also stated that in order for the audience to truly process the information, the document must be both informative and memorable. It was not enough to just have colorful pictures; if the information put forth was not accurate and informative, the viewer would have difficulty remembering it in the future. We made sure that the information presented in the video was as useful to the viewer as possible, and we left out any unnecessary information that would bore or confuse the viewer.

When font is difficult to interpret it can be frustrating for the reader and can cause them to lose interest (Schriver, 1997). We knew through personal experience that simple fonts such as Times New Roman and Arial are the easiest to read, so we chose Arial to be the main font used throughout the video. K.A. Schriver (1997) said that it is not only the font choice that affects readability, but also the size and amount of font used. The audience can be put off by small print or too much information. An example of how one could easily lose focus from small font is with letters such as "e", "a" and "o." In small font, these letters are easily confused or may appear as black dots (Schriver, 1997). If a viewer is confused or frustrated they are less likely to find interest in the information. Our instructions were legible and properly sized for small computer screens and televisions,

since the video will be viewed on these devices. The definitions and text also needed to be complete and concise. If there is too much text on the screen, it is likely that the viewer will either quickly skim through it or not read it at all (Schriver, 1997). It is suggested not to have more than seven or eight lines of text at a time on a screen. Clutter can overwhelming to the brain and can cause a lack of information retention (Andrews, 1998). Our video followed these guidelines; most of the time there were only one or two lines of text at a time.

A catchy opening is a significant part of getting the viewer's attention. The opening should summarize the topic and help explain to the viewer why it is important that they learn about it (Schriver, 1997). The first section of our video did just that; it was a photo montage set to music. The photos included pictures of rainforests, landfills, and compost related items. This was an interesting opening that would help to set the ideas presented within the video. After this opening, we defined composting, and explained why it was beneficial to the environment.

J.M. Lannon reported that it is important to emphasize the major topics. Viewers frequently only take interest in key points, which should be in bold or repeated multiple times. We made separate title pages for every portion of the video, as a way to let viewers know which parts were more important. We also repeated many of the key points throughout the sections and repeated solutions to composting problems in the Question and Answer section of the video.

D.C. Andrews claimed that the human mind can stay focused for approximately fifteen consecutive minutes before losing attention. He recommended changing styles or topics periodically. We did not want viewers to get bored while watching the video, which would defeat its purpose. We implemented Andrews' recommendations by changing the setting of our video in different sections. One section is in a kitchen, while the next is in a living room, and another in a greenhouse. These changes were enough to keep interest in the topic. This was why it was important to change visuals and change styles within the video.

All of the literature highlighted the importance of chunking. Chunking is the process breaking the information down into separate "chunks", which makes quick presentation of the information simpler. It also makes scanning the information for

relevance easier. This will be especially useful to home viewers who want to find a specific segment of the video using the menus. We chunked our information into three main categories (An Introduction to Composting, Composting Methods, and Common Problems) each of which were further chunked into subcategories.

K.A. Schriver reported that people often do not consult manuals until after they experience difficulty. For this reason, many instructional writers include a separate troubleshooting section at the end of the material. It is necessary to have a section that solely manages problems that may occur. Because of this, we decided to put a question and answer section at the end of our video. It is simple to find using the menus, and will help the viewer jump to the specific question that they have.

D.C. Andrews puts forth three major types of definitions. Formal definitions clarify an item's genus, and what distinguishes it from others within that genus. These definitions are useful by defining things in terms of what someone already knows. For example, we defined compost in the video as a "soil-like substance" (its genus) and refine it by saying that it is high in nutrients, and is the product of the process of composting. By defining it in this way, viewers will not confuse compost with sand or topsoil, two other soil-like substances. The second type is the stipulative definition. This type of definition is used to temporarily redefine a word for the purposes of discussion. This makes instructions easier and more efficient. These definitions helped us a great deal in our paper. We were able to define "browns" as high-carbon materials, ad give a list of many such materials. From then on in the video, instead of saying "high carbon materials such as leaves, paper, etc." we could simply say "browns" and the meaning of the word would be clear. The third type is the expanded definition, which can be expressed by using a picture, comparing items being defined, or though derivation. One expanded definition that we used was to show a 3:1 ratio of browns to greens by having three cups of brown construction paper and one cup of green construction paper in front of the narrator.

Repeating information can be used with repeated images, actions, or words. Reinforcement of information allows data to move from short term memory to long term memory. Schriver, Andrews, and Lannon confirm this in their texts. Our titles, instructions, and summaries involved repetition, but in a manner that was not boring. For

example, many common problems would have the same solution, but instead of stating the same exact solution for each, the words were rephrased so as to seem new. It was important to change sentence structure, tone, and images to keep the viewers interest when repeating items (Schriver, 1997).

The WPI Academic Technology Center (ATC) has a series of instructional videos at their website. These were good examples of how to make short instructional videos. The videos included title pages before each step, with an image related to the subject, and the title of the section. The title pages helped show what chunking had been done with the information. We implemented this method by having a title page for each of our chunks. Most pages had an image related to the subject.

Some of the instructional videos were more effective than others. One series of videos about Biomedical Engineering by WPI professor Ross Shonat and student Ryan Carey were exceptionally helpful. The subject was made entertaining and exciting with strong words and phrases, such as “bring physiology to life.” This concise and catchy language was used in our video in order to keep the audience interested.

Video Structure

In designing the video, we carefully considered our target audience. As was previously stated, the video will most likely be seen in a home setting and in a classroom setting. The latter required the video to have a cohesive narrative, so that it could be viewed in one sitting, while the former required menu interaction, so that the homeowner would be able to skip to the most relevant parts of the video. Our video outline (Table 3.1) attempts to cover both of these requirements. The video begins with Menu A, allowing the viewer to skip to important parts of the video. If the first option is chosen in Menu A, Sections I, II, and III will play in succession. Section I is an introduction to the idea of composting. It provides a definition of composting, and details its benefits. This is mainly for the classroom setting. For people to want to compost, they need to know why composting is important, how it will help the environment, and even their own backyards. The homeowners will hopefully already be intending to compost, so this section is not geared towards them.

Section II highlights the different methods of composting, and gives instructions for each. It begins with a summary of the methods we will be showing. This summary not only shows the pros and cons for each method, but the suggested yard spaces required as well. Following the summary, general information that applies to all methods is shown. This portion includes things such as the difference between "brown" and "green" materials, definition of aeration, etc. Following this, a detailed description of each method is shown. Viewers can either choose to view all methods sequentially (useful for a classroom) or pick out one method based on individual needs (useful for homeowners). Menu B is here, allowing the viewer to watch all methods sequentially (useful for a classroom) or pick out one method based on individual needs (useful for homeowners).

Section III tries to answer many common questions or problems that can occur while composting. It is set up similar to Section IV. There is a "play all" feature that, when selected, simply plays through every common problem, stating the solutions. There is also the option to individually select one problem and see just that solution. This will be valuable to the homeowners who are having a specific problem. Instead of having to watch through the whole section, they will be able to skip to the exact question they have.

Table 0.1. Menu outline of video.

Main Menu o Play All o An Introduction to Composting o Composting Methods o Common Problems
I. An Introduction to Composting o What is Composting? o Why Should you Compost?
II. Choose your method o Play All o Summary of Methods o General Tips o Garbage Can Method o Wire Mesh Method o Six-Hole Method o Worm Composting Method o Main Menu
III. Common Problems o Q and A o Main Menu

Choosing an Editing Program

Creating a professional instructional video required an editing tool so the desired video could be achieved. In current age of technology digital video editing has become the standard. It requires a video camera capable of transferring the video via firewire or USB 2 connections, video editing software capable of exporting in the desired format, and a computer with enough memory and hard drive space to support the video files and video editing program requirements. A particular brand of computer and video camera is

not critical. They only need to satisfy the requirements stated. However the editing program used will directly affect the quality of the final product. The number of features and the ease of an inexperienced person using them will also affect the video. For example, the ability to do transitions and incorporate titles, images, audio overlays and videos/photos together smoothly is going to provide more options than simply lumping different photos and video sections together. For this reason, a set of criteria that described the features that we needed in a video editing program allowed us to compare different programs and choose one.

All consumer and professional level video editing software packages have a basic set of features that enable the user to complete basic video editing tasks. They allow the user to import video, cut the video into different parts, and recombine it with transitions. They enable the user to have subtitle overlays and audio overlays. Depending on the quality of the program the power and flexibility of these features will vary. For example, a free program, such as Windows Movie Maker, allows you to overlay text on the video. However, only one block of text with a set number of properties can be overlain at a time. With Adobe Premiere, a professional level program, you can have many overlays with independent properties. We needed to distinguish which features are commonplace and which are unique to different programs along with what unique features were necessary for the project. The following is a list of features that are not shared among all programs and were required for creating our instructional composting video:

The software needed to:

- Be accessible to the IQP Team
    - We needed to be able to afford to buy the software or have it already available to us, and be able to begin using it quickly.
- Be able to import and export industry standard high resolution formats
    - For example AVI, DV, MPEG-2. These are high resolution formats that are suitable for a DVD. Using any lower quality would result in a grainy low quality video.
- Allow for panning and zooming
    - This allowed us to create a more professional looking video in addition to giving us more flexibility after we had the raw footage. It allowed us to

show wide angle shots of an area as well as close ups of detailed tools and processes.

- Allow for key-framing in audio and video effects
    - Key-framing is the ability to set starting frames (points) and ending frames within a video or animation where video and audio effects should be applied. All programs allow you to apply various video effects such as slow/fast motion to video and audio. The ability to key-frame greatly increases the power of these features. So instead of having them be applied to the whole video file, you can set them exactly where you want within it.
- Allow Multitrack editing
    - Multitrack editing allows you to work with more then one video in parallel so that you can then overlay, or switch between. This allowed us to easily have video of, for example, someone talking, which then cut to a visual example of what he was talking about, and then cut back to him talking, all the while his talking stayed continuous.
- Have the ability to author multiple DVD menus that can be linked to one another.
    - This enabled us to have a flexible video so that users can access the information that they want quickly and easily without having to fast forward and rewind.

With these criteria established, different programs were compared, so that the best program could be chosen. In Table 4.1 different products and features are compared (See Table A.1 in Appendix A for a more detailed comparison). Six programs are compared, which consist of four video editing and two photo slideshow programs. In choosing programs to compare, we chose a variety that ranged from freeware to professional quality. We could not compare every program on the market, so we chose programs based on their potential availability and their ratings. PCMag.com lists the top four video software programs as Adobe Premiere Pro CS3, Apple Final Cut Studio 2, Ulead VideoStudio 11 Plus, and Pinnacle Studio Ultimate 11. Our personal experience with Ulead VideoStudio and Pinnacle Studio had shown that they were very similar in their

capabilities. Pinnacle Studio 10 Plus was personally owned and used by one of the group members, so that was an obvious candidate for a program. Adobe Premiere was chosen for the comparison because it was the leading video editing software for PC based computers and Adobe Premiere Pro 2.0 was available at WPI's media lab. The other leading software is Apple Final Cut Studio Pro 2, so this was chosen for comparison. Windows Movie Maker 2.1 is a freeware program available with all computers installed with Windows XP. This was compared, because most PCs had it installed. We included photo slideshow programs in our search, in case we decided to do a video composed of all still images. Two slideshow programs were compared: ProShow Gold and Photostory 3. ProShow gold was one of the top rated photo slideshow programs and was owned by one of the group members. Photostory 3 was another freeware program created by windows. It is a subset of Windows Movie Maker.

Table 0.2. Software comparison.

Video					Photo Slideshow	
Product Feature	Pinnacle Studio 10 Plus	Adobe Premiere Pro 2.0	Final Studio 2	Windows Movie Maker 2.1	ProShow Gold	PhotoStory 3
Price/OS	$80/Both	$848/Both	$1299/Mac	Free/Windows	69.95/Both	Free/Windows
Existing Availability	Yes	Yes	No	Yes	Yes	Yes
Import/Export correct formats	Yes	Yes	Yes	Almost	Yes	No
Panning& Zooming	Yes	Yes	Yes	Limited	Yes	Yes
Key Framing	Yes	Yes	Yes	No	Limited	No
Multitrack Editing	Yes	Yes	Yes	No	No	No
DVD Menus, Linked, Multiple	Yes	N/A	Yes	No	No	No

By taking this information and rank ordering each feature from 0 to 3, we decided what program was best. This was done in Table 4.2. A rank of "0" means that the software did not meet our needs in the category. For example, Final Studio 2 was only available on a Macintosh; none of the team members owned a Macintosh, so it was marked with a "0" for existing availability. A rank of "1" means that the software met the basic requirements of that category, but would severely limit our final video. A rank of "2" means that the software met the requirements of that category and would be sufficient, but was not exactly what we need to complete the project. A rank of "3" means that the software had all of the features that we needed in that category to best to make the video.

Table 0.3. Rank Comparison.

Video					Photo Slideshow	
Product Feature	Pinnacle Studio 10 Plus	Adobe Premiere Pro 2.0	Final Studio 2	Windows Movie Maker 2.1	ProShow Gold	PhotoStory 3
Price/OS	2	0	0	3	2	3
Existing Availability	3	3	0	3	3	3
Import/Export correct formats	3	3	3	2	2	2
Panning& Zooming	3	3	3	1	2	3
Key Framing	3	3	3	0	1	0
Multitrack Editing	3	3	3	0	0	0
DVD Menus, Linked, Multiple	2	3	3	0	0	0
Total	19	18	15	9	10	11

As seen in the above chart, the Pinnacle Studio 10 Plus was the best choice for a video editing program; the second best was Adobe Premiere. Pinnacle Studio 10 Plus met every requirement (meaning that it had no "0" values) and was already owned by a team member who had ample experience with it. For this reason, the team used this program to create the content for the instructional video. Pinnacle Studio 10 Plus did not have the DVD authoring ability to easily have both a play all option and the option to select different chapters. Therefore, Adobe Premiere was used to create the DVD structure. This was decided after talking with the Academic Technology Center at WPI. They confirmed that the Adobe Premiere that was available to us has the capability to create a DVD menu structure that allowed us to play all and play just sections of the video.

CHAPTER 4: RESULTS

With most major projects, things do not always go as planned. A method that was thought to be ideal will turn out not to be, and steps may take longer than originally planned. A successful project team will adapt to these obstacles and overcome them. During the production of our video we ran into many challenges, which taught us valuable skills and techniques for future use. In this chapter, we describe what we learned during the writing of the script, while organizing the video shoot, and while editing the video. We also present our final products: the script and the video.

Revising the Script

When writing the script, we attempted to keep the language as simple as possible. The primary viewing audience, in general, does not have English as a first language, and we did not want anything to get lost in translation. Instead of using many synonyms to keep the language fresh, we decided to repeat the same words, hoping that this would help the audience to keep up. When it came time to film, and the writing was read aloud, it sounded very unnatural, however. We then decided that it would be better to use a few different words, but to still keep them simple and easily understandable.

In writing and revising the script, we tried to incorporate much of what we learned about instructional writing techniques. Each time we made another revision to the script, we would apply the instructional writing knowledge. For example, we chunked the information more every time we went through. The information was originally somewhat disorganized, but as we learned about and became more experienced with chunking, we were able to improve the organization to make it easier for the audience.

In addition to writing a script, we also had to design graphic pages to insert into our video. One such page consisted of a pictograph detailing the traits of the four different composting methods, and these pictographs were then used to compare the methods. There were four traits we wanted to show: The ease of building and maintaining the method, the speed the compost processes at, the quality of the compost, and the yard

size requirement. Figure 4.1 shows an example of our final pictograph. We needed to quantify each trait in terms of whether each method was better or worse. We wanted to indicate this by using a scale of icons. However, we realized that these numerical representations might confuse a viewer if they did not all follow the same format. Therefore all but the size category use the same format; we set it up so that more is always better except in the case of the space required. We carefully explained to the audience through voiceover the meaning of each trait and symbol, so as to avoid confusion. Through many revisions we learned the importance of maintaining visual and conceptual consistency.

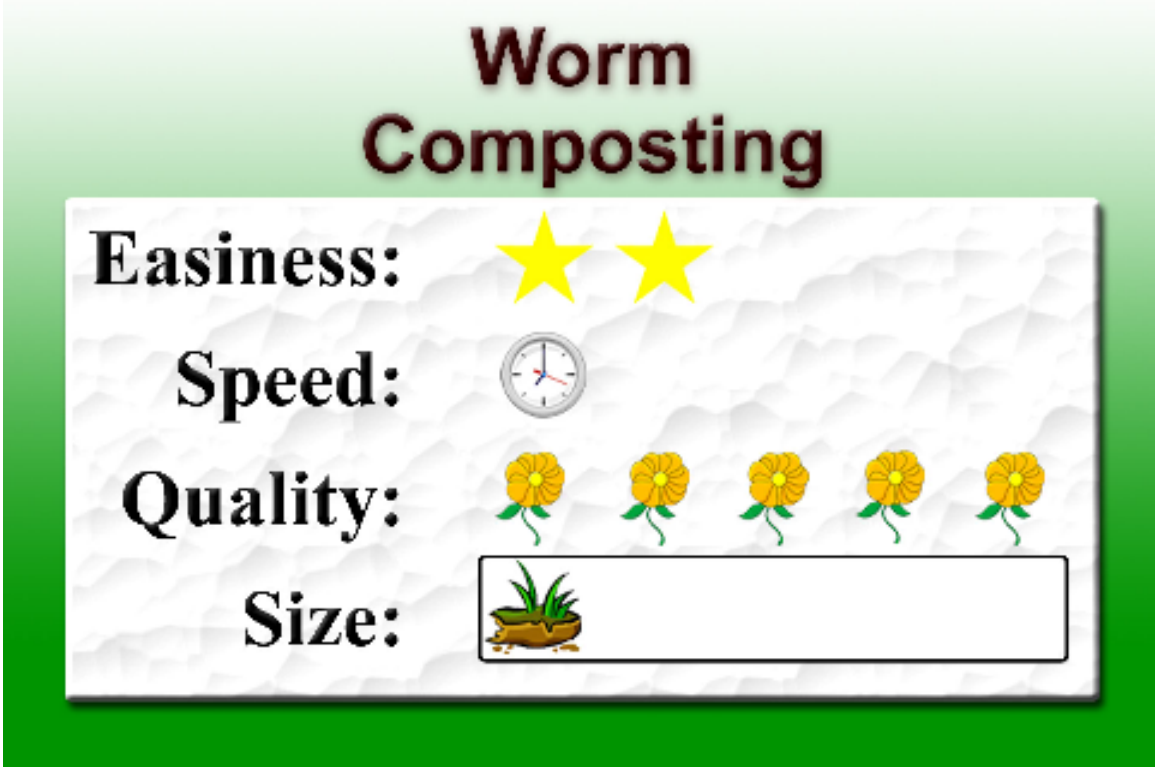

Figure 0.1. A Pictograph Summarizing the Worm Composting Method.

Organizing the Shoot

Another aspect of the script that we changed was not content, but format related. Our original script was written in power point, with different topics of the video getting their own slides. This was convenient to use while writing it, but once it came time to actually film, we found that it was too confusing. We needed a document that would help us to easily keep track of which scenes were to be filmed, which were to be voiceovers, and the materials we needed for each scene. We decided to reformat the script into a Word Document with a linked table of contents. In this format it was easier to keep track of what we need to do and what we had already done. A table of scenes was placed at the beginning with boxes to check once completed. This table, along with the full script, can be seen in Appendix B.

Being able to number the scenes was also convenient for scheduling our time to film and edit. We had originally planned to just film as much as we could at once, but we soon realized that the logistics of organizing materials were such that we had to carefully plan out what, where and when we were going to film.

Figure 3.1 shows an example page of the script. At the top we put the name of the segment and what materials are required, along with a scene number. Since this is a video segment, the speaking field is filled in, and the voiceover field is left blank. The checklist and notes on the section can also be seen.

Name:	Why Should You Compost Video	**Materials:** Photo of landfill
Scene:	2	
Type:	Video	
Speaking:	You can use compost in home or community gardens or for potted plants. Compost has more nutrients than regular soil, and will help plants to grow better. By turning food scraps and waste materials into compost, you will decrease your amount of trash. This will slow down the growth of Costa Rican landfills*<show photo of landfill>,* which destroy and pollute the environment. Costa Rica is known for its rainforests and wildlife, and by composting, you can help to preserve these natural resources.	
Voiceover:		
Visual	Video of speaker in a kitchen	**Checklist** Materials? Location? √ Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**
	n/a	n/a	n/a

Figure 0.2. Example of Script Page.

There were things that we learned that may not have taught us much in and of themselves, but collectively were a good lesson in organizational skills. First was the difficulty in reserving locations and equipment. The wireless microphone that we borrowed from the school could only be taken out for short periods of time, so we had to plan our filming schedule accordingly. Likewise, the greenhouse could only be filmed at during the daytime because of lighting, so we also had to fit the schedule around that and our classes. Second was the use of prompters, or cue cards. We had originally planned that the narrator would memorize the lines for the scene being filmed, but when we started shooting it proved more difficult than anticipated. We were forced to use makeshift cue cards written on paper towels, which was less than ideal. The next time we filmed we made sure to bring paper with the script printed in large font. This experience taught us how to plan ahead and how to adapt quickly to obstacles.

Editing the Video

One problem we ran into when editing the video was how to format the title pages. In the video we had three different levels or title page heading levels. In order to make it easier to understand and distinguish between them, we decided to use the same background theme for each level, much like in a paper how different fonts and sizes represent which level they are at. We created a hierarchy of scenes (see Appendix C) to keep track of which level each was at. We ran into difficulty because our video has three main sections (An Introduction to Composting, Methods of Composting, and Common Problems), but two of these sections are menu screens while one is a video. We needed to distinguish menu screens from video title pages, but we still needed these three to look the same. We eventually decided to make separate pages from the menus that are only viewable when "Play All" is selected on the Main Menu. These pages will have the same background to distinguish them as the major sections. Since "Play All" will mostly be used by people unfamiliar with the video, the hierarchy will be clear, as they will not see the secondary menus. People who choose to go to a different menu will have probably already seen the video, and so will not need to know the organizational structure.

Another problem that became clear during editing was that some sections of our video were boring. Many of the segments were just the narrator speaking to the camera, which had the tendency to seem too long. We did not have sufficient time to re-shoot all these scenes, so we had to find an alternative solution. We decided to fade to pictures related to the topic being discussed during these scenes instead. This helps to shift the viewer's attention, from the video of the narrator, to what is being said.

Final Product

Our final video is 20 minutes in length. As detailed in the Methods chapter, it has three major sections, An Introduction to Composting, Composting Methods, and Common Problems. The introduction gives a definition of composting, and some reasons that people should do it. The composting methods section begins with a summary of the four methods we present, comparing them using the pictographs shown in Figure 4.1. We then present some general tips that apply to composting in general. The four methods are then shown, with details on how to build and maintain the composter, as well as how to harvest the completed compost. The common problems section lists many problems that are common when composting, and gives three or four solutions for each. These sections are all linked together through an interactive menu design. Composting Methods and Common Problems each have their own menu, so that a viewer may be able to skip to exactly what he or she wants to view. There is also a "play all" option on the main menu that simply plays everything on the DVD.

CHAPTER 5: CONCLUSION

The completion of this project and its deliverables has created an opportunity to help the environment not only in Costa Rica, but in other places as well. The implementation of composting in other countries and regions would be a step in the right direction towards solving the global waste management problem. Worcester Polytechnic Institute's project groups could provide the service of adjusting the presentation of the information provided in this video for different audiences or convert it to alternate mediums. The DVD could be translated for use in countries where no English is spoken. Video is an inexpensive and easy way to educate citizens on the importance of composting, and how it can be done in the home. These factors are critical in countries with less funding because they may find it more difficult to devote resources towards educating their citizens on composting. Another option is to convert the instructional video to pamphlets to help educate people who do not have access to the required equipment to watch videos. Pamphlets could be made in Spanish or alternate languages, so that they are easy to understand. It is simpler to translate text, than it is to translate or add subtitles to a video. This would expand the audience that can be educated on the information we have presented on composting.

Many of the current waste management practices are wasting time, while damaging the environment. These issues can only be resolved through educating the waste producing population on the implications of their actions. If people can be educated and motivated to change their current waste disposal methods towards composting more, then that will result in less waste that is inefficiently disposed of. Extending this goal beyond Costa Rica will assist in solving the global problem.

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APPENDIX A: COMPARISON OF VIDEO EDITING PROGRAMS

The following table (Table A.1) is a comparison chart of four video editing programs and two slideshow producing programs. The objective of this chart was to be able to compare the various programs to determine which best suited our needs.

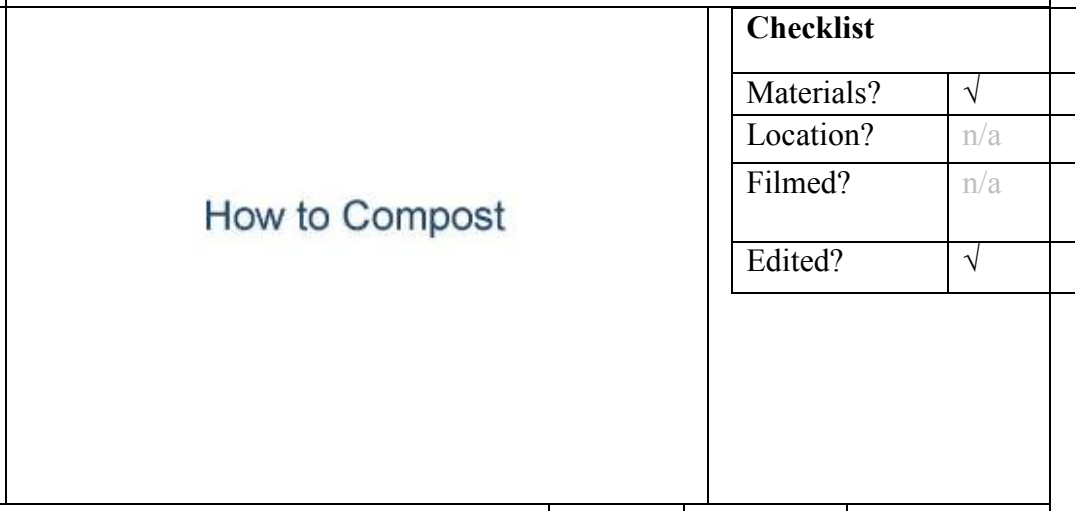
	Video				Photo Slideshow	
Product Feature	Pinnacle Studio 10 Plus	Adobe Premiere Pro 2.0	Final Studio 2	Windows Movie Maker 2.1	ProShow Gold	PhotoStory 3
Price	$80	$848	$1299	Free	69.95	Free
Availability	One member owns	Movie Labs		Any PC with Windows XP	One Member Owns	Any PC
OS	Windows and Mac	Windows and Mac	Mac	Windows	Windows and Mac	Windows
Import File Formats	DivX files, non-encrypted DVDs, WMV, HD	Professional format support from DV to uncompressed HD	Professional format support from DV to uncompressed HD	DV, WMV, MPEG-1, AVI	Standard Photo Formats, JPEG GIF	Standard Photo Formats, JPEG GIF
Export File Formats	MPEG-1,MPEG-2, AVI, QuickTime, and WMV and more	MPEG-1,MPEG-2, FLV, AVI, QuickTime, and WMV and more	MPEG-1,MPEG-2, AVI, QuickTime, and WMV and more	DV, WMV, AVI	MPEG-1,MPEG-2, FLV, AVI, QuickTime, and WMV and more	WMV
Real-Time Full Resolution Preview	Yes	Yes	Yes	Yes	Yes	
Transitions	266	Yes	Yes	60	280	Yes
Image Stabilization	Yes		Yes	No	N/A	N/A
Color Correction	Yes	Yes	Yes	No	Yes	
Pan-and-Zoom	Yes	Yes	Yes	Limited	Yes	Yes
Key-Framing in audio and video effects	Yes	Yes	Yes	No	Limited	No
Reverse Video	Yes	Yes	Yes	No	N/A	N/A
Fast/Slow motion	Yes	Yes	Yes	Limited	N/A	N/A

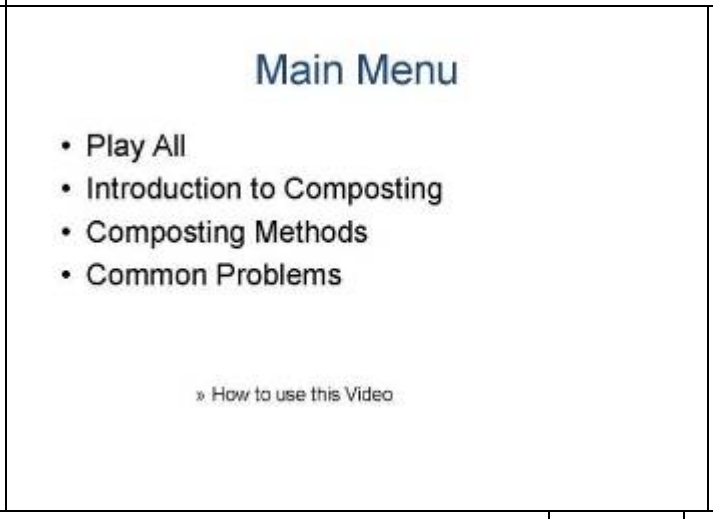
Multitrack editing	Yes	Yes	Yes	No	No	No
PIP	Yes	Yes	Yes	No		No
Chroma Key	Yes	Yes	Yes	No	No	No
DVD Authoring	Yes	No	Yes	No	Yes	No
DVD Motion buttons and backgrounds	Yes	N/A	Yes	N/A	Yes	N/A
Multiple Menus	Yes	N/A	Yes	N/A	No	N/A
Menu-Menu Links	Yes	N/A	Yes	N/A	No	N/A

APPENDIX B: FULL SCRIPT

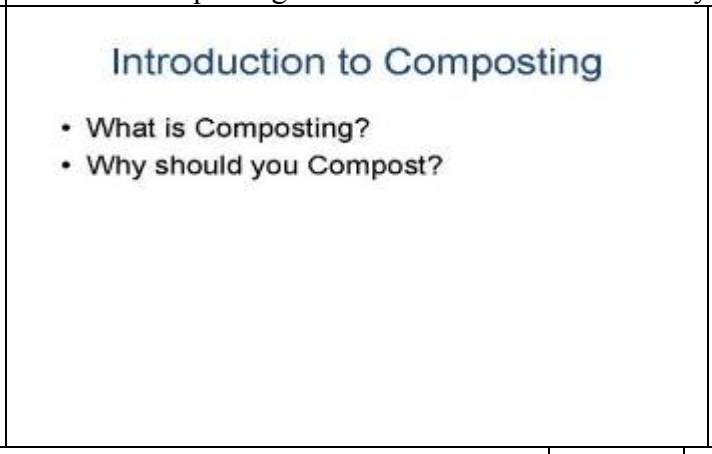
Name	Type	Scene	Materials?	Location?	Filmed?	Edited?
How to Compost	Graphical	A		n/a	n/a	√
Main Menu	Menu	AA	n/a	n/a	n/a	√
Introduction to Composting	Graphical	C	n/a	n/a	√	√
What is Composting?	Graphical	D	n/a	n/a	√	√
What is Composting Video	Video	1	√	√	√	√
Why Should You Compost?	Graphical	E	n/a	n/a	√	√
Why Should You Compost Video	Video	2	√	√	√	√
Composting Methods Menu	Menu	BB	n/a	n/a	n/a	√
Composting Methods Summary	Graphical	Alpha	n/a	n/a	n/a	√
Summary of Methods	Graphical	F	n/a	n/a	√	√
Summary of Methods Intro	Graphical	G	n/a	n/a	√	√
Garbage Can Composter	Graphical	H	n/a	n/a	√	√
Wire Mesh Composter	Graphical	I	n/a	n/a	√	√
Six Hole Method	Graphical	J	n/a	n/a	√	√
Worm Composting	Graphical	K	n/a	n/a	√	√
General Tips	Graphical	L	n/a	n/a	√	√
General Tips Video	Video	3	√	√	√	√
Garbage Can Composter	Graphical	M	n/a	n/a	√	√
Garbage Can Composter Video	Video	4	√	√	√	√
Wire Mesh Composter	Graphical	N	n/a	n/a	√	√
Wire Mesh Composter Video	Video	5	√	√	√	√
Six Hole Method	Graphical	O	n/a	n/a	√	√
Six Hole Method Video	Video	6	√		√	√
Worm Composting	Graphical	P	n/a	n/a	√	√
Worm Composting Video	Video	7		√	√	√
Question and Answer Menu	Menu	CC	n/a	n/a	n/a	√
Question and Answer	Graphical	Q	n/a	n/a	√	√
Is your compost not maturing?	Graphical	R	n/a	n/a	√	√
Moisture Level	Video	8	√	√	√	√
Size of Pile Video	Video	9	√	√	√	√
Green/Brown Ratio	Video	10	√	√	√	√
Does your compost have an ammonia odor?	Video	11	√	√	√	√
Does your compost have a rotten odor?	Graphical	S	n/a	n/a	√	√
Moisture Level	Video	12	√	√	√	√
Oxygen Level	Video	13	√	√	√	√
Unmixed Food Scraps	Video	14	√	√	√	√
Is your compost attracting flies?	Video	15	√	√	√	√
Is your compost attracting animals?	Video	16	√	√	√	√
Is your compost failing to heat up?	Graphical	T	n/a	n/a	√	√
Lack of Oxygen	Video	17	√	√	√	√

Lack of Green Materials	Video	18	√	√	√	√
Small Pile	Video	19	√	√	√	√
Is the temperature of your compost.. ?	Graphical	U	n/a	n/a	√	√
Lack of Oxygen	Video	20	√	√	√	√
Lack of Green Materials	Video	21	√	√	√	√

Name:	How to Compost Title	**Materials:** **Photos**			
Scene:	A				
Type:	Title Page				
Speaking:					
Voiceover:					
Visual					
		Checklist			
		Materials?	√		
		Location?	n/a		
		Filmed?	n/a		
		Edited?	√		
Notes:		**Color:**	**Font**	**Background**	
ProShow Gold photo slideshow with music					

Name:	Main Menu	**Materials:**			
Scene:	AA				
What:	Menu				
Speaking:					
Voiceover:					
Visual					
Notes:		**Color:**	**Font**	**Background**	

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	n/a
Edited?	√

Name:	Introduction to Composting	**Materials:**		
Scene:	C			
Type:	Information Page			
Speaking:				
Voiceover:	Welcome to how to compost. In this introduction, we will discuss what composting is, and why it is a good idea. In later sections we will show different composting methods and how to solve many common problems			
Visual				
Notes:		**Color:**	**Font**	**Background**
topics appear as spoken				

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Name:	What is Composting?	**Materials:**			
Scene:	D				
Type:	Title Page				
Speaking:					
Voiceover:	What is Composting?				
Visual	What is Composting? 		**Checklist**		
			Materials?	n/a	
			Location?	n/a	
			Filmed?	√	
			Edited?	√	
Notes:		**Color:**	**Font**		**Background**

Name:	What is Composting Video	**Materials:**
Scene:	1	
Type:	Video	
Speaking:	Composting is the decomposition of organic matter. Composting materials can include paper, yard waste, and foods such as rice, beans, coffee and fruit and vegetable scraps. The goal of composting is to decompose the waste in order to produce a soil-like substance that can be used for gardening. The process of composting involves mixing these materials in the yard, or some sort of bin, and tending to them. Over the course of a few months, these materials will turn into compost.	
Voiceover:		
Visual	Video of speaker in a kitchen	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**
	n/a	n/a	n/a

Name:	Why Should You Compost?	**Materials:**			
Scene:	E				
Type:	Title Page				
Speaking:					
Voiceover:	Why Should you Compost?				
Visual					
Notes:		**Color:**	**Font**	**Background**	

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Name:	Why Should You Compost Video	**Materials:** Photo of landfill		
Scene:	2			
Type:	Video			
Speaking:	You can use compost in home or community gardens or for potted plants. Compost has more nutrients than regular soil, and will help plants to grow better. By turning food scraps and waste materials into compost, you will decrease your amount of trash. This will slow down the growth of Costa Rican landfills*<show photo of landfill>,* which destroy and pollute the environment. Costa Rica is known for its rainforests and wildlife, and by composting, you can help to preserve these natural resources.			
Voiceover:				
Visual	Video of speaker in a kitchen	**Checklist** Materials? √ Location? √ Filmed? √ Edited? √		
Notes:		**Color:**	**Font**	**Background**
		n/a	n/a	n/a

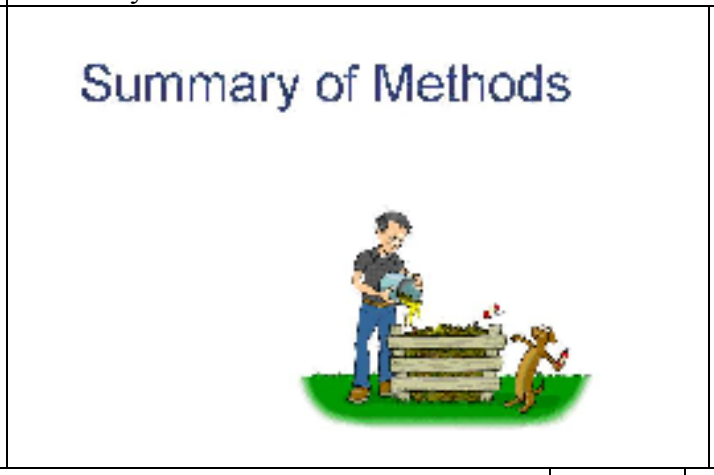
<table>
<tr><td>Name:</td><td>Composting Methods Menu</td><td colspan="4">Materials:</td></tr>
<tr><td>Scene:</td><td>BB</td><td colspan="4" rowspan="3"></td></tr>
<tr><td>Type:</td><td>Menu</td></tr>
<tr><td>Speaking:</td><td></td></tr>
<tr><td>Voiceover:</td><td colspan="5"></td></tr>
<tr><td>Visual</td><td colspan="5"> 

<table>
<tr><td colspan="2">Checklist</td></tr>
<tr><td>Materials?</td><td>n/a</td></tr>
<tr><td>Location?</td><td>n/a</td></tr>
<tr><td>Filmed?</td><td>n/a</td></tr>
<tr><td>Edited?</td><td>√</td></tr>
</table></td></tr>
<tr><td colspan="2">Notes:</td><td>Color:</td><td>Font</td><td colspan="2">Background</td></tr>
<tr><td colspan="2">Same general theme as main menu, but maybe with slight changes so the menus don’t become confusing.</td><td></td><td></td><td colspan="2"></td></tr>
</table>

Name:	Composting Methods Menu	**Materials:**
Scene:	Alpha	
Type:	Title Page	
Speaking:		
Voiceover:	Composting Methods In this portion of the video we will give a brief summary of different composting methods, offer some general tips, and we will detail how to build and maintain the garbage can, wire mesh, six hole and worm composting methods.	
Visual		

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	n/a
Edited?	√

Notes:	**Color:**	**Font**	**Background**
Same general theme as main menu, but maybe with slight changes so the menus don't become confusing.			

Name:	Summary of Methods	**Materials:**
Scene:	F	
Type:	Title Page	
Speaking:		
Voiceover:	Summary of Methods	
Visual		

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Summary of Methods Intro	**Materials:**
Scene:	G	
Type:	Information Page	
Speaking:		
Voiceover:	In choosing a composting method, you need to consider many factors. The first factor is how easy the composter is to maintain. An easier method will have more stars on the chart. The next factor to consider is the speed at which compost is produced. More clocks on the chart mean it will compost quicker. The next factor to consider is the quality of the compost. More flowers on the chart mean higher quality compost. The final factor to consider is the yard space required by each method. More green blocks means more yard space required. We will now introduce a few methods and discuss their advantages and disadvantages.	
Visual		

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**
Active graphical display of how the rating system works. After saying each category the stars will appear etc			

Name:	Garbage Can Composter	**Materials:**
Scene:	H	
Type:	Information Page	
Speaking:		
Voiceover:	The Garbage can method consists of drilling holes in the side of a garbage can and filling it with composting materials. The Garbage Can method is a very easy way to make compost. The only regular work it requires is to roll the garbage can on the ground in order to mix the materials. The compost will be created within several months. The completed compost will be of very high quality. This method also requires little space – only enough for the garbage can and room to roll it around.	
Visual		

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**
Active graphical display rating the method			

Name:	Wire Mesh Composter	**Materials:**
Scene:	I	
Type:	Information Page	
Speaking:		
Voiceover:	The Wire mesh method consists of forming a length of wire mesh into a circle to hold the composting materials. The Wire mesh method requires more work than the garbage can method. To mix the materials you need to dump out and put the material back in. The compost will be created within several months. The completed compost will be of very high quality. This method requires a yard large enough to hold the wire mesh container and to mix it.	
Visual		**Checklist** Materials? n/a Location? n/a Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**
Active graphical display rating the method			

Name:	Six Hole Method	**Materials:**
Scene:	J	
Type:	Information Page	
Speaking:		
Voiceover:	The Six hole method consists of digging a series of holes in the ground and placing the composting materials in them. You begin by filling up the first hole with composting materials. When that hole is mostly full, you cover the rest of it with dirt from a second hole. The second hole is then filled with materials and covered with dirt from a third hole, and so on. The Six hole method is the easiest method of all after the holes are dug. No mixing of the materials is required, and the nutrients can be absorbed directly into your garden. The compost will be created within one or two months. The completed compost will be of average quality. This method requires a yard large enough to dig multiple holes in.	
Visual		**Checklist** Materials? n/a Location? n/a Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**
Active graphical display rating the method			

Name:	Worm Composting	**Materials:**
Scene:	K	
Type:	Information Page	
Speaking:		
Voiceover:	Worm composting consists of keeping a bin full of worms in a bedding of moist newspaper and cardboard. You must also regularly feed them food scraps. Worm Composting is more difficult than the other methods. The worms require weekly feeding and care. Worm composting takes much longer than the other methods. The completed compost will be of the highest quality. This method does not require a yard, and can be done indoors.	
Visual		**Checklist** Materials? n/a Location? n/a Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**
Active graphical display rating the method			

Name:	General Tips	**Materials:**		
Scene:	L			
Type:	Title Page			
Speaking:				
Voiceover:	Now we'll talk about some general tips that will apply to every method except for worm composting, which requires different techniques than the other methods.			
Visual		**Checklist**		
		Materials?	n/a	
		Location?	n/a	
		Filmed?	√	
		Edited?	√	
Notes:		**Color:**	**Font**	**Background**

Name:	General Tips Video	**Materials:**
Scene:	3	Room, long table, gloves, shovel, tarp, watering can, brown and green materials(newpaper, twigs, hay, cardboard, fruit peels, coffee grounds, egg shells), clear plastic cups, brown and green construction paper, (Meats, bones, fats, grease, oils and dairy products), 3 clear buckets, soil
Type:	Video	
Speaking:	**Scene 3A** (Title: How to prepare for composting) *<sitting or standing at a table, with the tools that we list on the table>* "Composting will require certain preparations before you start. Depending on the composting method you choose, you will need to set aside an area large enough for the work you need to do. Next, you will need the building supplies to make your composter. These supplies are unique to each method, and will be discussed later. Before composting you should have enough materials to fill your composter half way. Until that time your browns and greens should be stored seperately, in the coolest and driest place you can find. The last thing you need to begin composting are tools.*<pick up gloves from table>* You should have gloves to handle the composting materials.*<pick up shovel>* You should also have a shovel or pitchfork to help mix and move the materials. *<pick up watering can>* A water container or hose is necessary to keep the compost moist. Transition: Fade **Scene 3B** (Title: What materials to compost) "One of the most important factors in composting is the materials that you use. These materials will fall into two categories, Browns and Greens. *<pick up each object as mentioned>* Browns, which are high in Carbon, consist of dried grass, leaves and twigs, Black and white newspapers, cardboard, or straw. Greens, which are high in nitrogen, consist of fresh grass, leaves and twigs and most food wastes, including fruit peels, coffee grounds, or egg shells.*<have some shredded cardboard and newspaper on table, and pick up>* It is important that these materials be shredded into small pieces before being composted.*<have 4 cups on table, 3 filled with brown, 1 with green>* The best amount of materials to use is three parts Brown to one part Green. There are also certain things that should never be composted.*<pick up from table as mentioned>* Meats, bones, fats, grease, oils and dairy products will create odors that can attract small rodents.*<cut away to picture of diseased plants>* Diseased or insect covered plants can corrupt the compost and transfer the problems to other plants.*<cut away to picture of pet waste>* Pet wastes may contain diseases and parasites, which can

	be transferred to humans when working with compost. Transition: Fade **Scene 3C** (Title: How to add the materials) *<on a table in front of actor have a clear bucket, with 2 other piles of green/brown shredded paper. Fill bucket as described>* "When adding materials it is a good idea to alternate layers of browns and greens. When first adding materials, begin with a base layer of about five centimeters of browns. Add a layer of greens on top of that. Make sure to keep the compost slightly moist with water while doing this. Continue to layer like this until all of your materials are gone. Layering is not necessary, but it will speed up the composting process. *<mix shredded paper into second bucket>* If you don't want to layer, you can simply mix the materials in together as you add them. Transition: Fade **Scene 3D** (Title: What you should know) "There are three main factors that will determine how well your composter works. Your compost should always be slightly moist. If it is not, you should add water to it, but not too much. If it is dripping wet your composter may fail. Because of this, protecting your composter from heavy rains is suggested.*<show tarp>* A tarp will work well for this. Another factor in composting is temperature. The temperature of your compost is an indicator of how well it is composting. If it is not warm to the touch, then something is wrong. Look at the common problems section to correct this. The third factor to remember is aeration. Aeration is the exposure of your compost to the air. Compost needs a lot of air flow, which can be provided by mixing. Bad aeration can lead to your compost smelling, in which case see the common problems section. Transition: Fade **Scene 3E** (Title: How to know when your compost is done) "Composting takes fifty to sixty days to reach completion. You can tell if the compost is done by sight and smell.*<have soil in a clear cup, and pick up the soil>* The completion of your compost can be determined by noting the amount of dirt-like substance. If you can still see food, twigs, or other objects, then the waste is still composting. Finished compost should smell like forest soil."	
Voiceover:		
Visual	Video of actor at a standing at a table	**Checklist**

		Materials?	√
		Location?	√
		Filmed?	√
		Edited?	√

Notes:	**Color:**	**Font**	**Background**
Between each topic we'll have a slide introducing the new topic with a title. There will also be pictures in between the video of whatever we need. Cross fade between pictures and between a title and its related section			

Name:	Garbage Can Composter	**Materials:**
Scene:	M	
Type:	Title Page	
Speaking:		
Voiceover:	In this section we will discuss how to compost using a Garbage Can Composter. This method consists of drilling holes in the side of a garbage can and filling it with composting materials	
Visual	Garbage Can Composter 	

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Garbage Can Composter Video	**Materials:**
Scene:	4	garbage can, duct tape, bungee cord, bricks/rocks
Type:	Video	
Speaking:	**Scene 4A** Title: Tools and materials) "To build your garbage can composter you will need certain materials and tools. *<display garbage can>* You will need a garbage can with a lockable lid. The garbage can should be 100-150 liters in size. If the lid does not lock, you will need another way to secure the lid. *<show securing of lid with cord and tape>* Duct tape or bungee cords will work well. *<pick up drill with drill bit in it>* You will also need a drill with a 10 mm drill bit. *<show bricks or rocks>* It is also a good idea to put rocks or bricks under the completed composter if you have them. Transition: Fade	
Voiceover:	**Scene 4B** (Title: Building your Composter) "Now that you have your tools and materials collected, the first step in building your composter is to drill holes in the garbage can. You should drill about 50 holes around the sides, bottom and lid of the trash can in any pattern. After these are drilled you can layer or mix in the composting materials, and place it anywhere in your yard. You can place the composter on top of rocks or bricks to help with aeration. **Scene 4C** (Title: Maintaining your composter) Mixing the compost using the garbage can method is very easy. Lay the garbage can down on its side, making sure the lid is locked tight, and roll the can on the ground a few times. This should ensure that the compost is mixed well. **Scene 4D** (Title: Harvesting your compost) When your compost is completed, you can either dig it out with a shovel to place in your garden, or you can pour it directly onto your garden from the garbage can. Finished compost will also fall out of the holes when mixing.	
Visual	Video of actor at a table and in a greenhouse	**Checklist** Materials? √ Location? √ Filmed? √ Edited? √
Notes:	**Color:**	**Font** **Background**

Name:	Wire Mesh Composter	**Materials:**
Scene:	N	
Type:	Title Page	
Speaking:		
Voiceover:	In this section we will discuss how to compost using a Wire Mesh Composter. The Wire mesh method consists of forming a length of wire mesh into a circle to hold the composting materials.	
Visual	Wire Mesh Composter 	**Checklist** Materials? n/a Location? n/a Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**

Name:	Wire Mesh Composter Video	**Materials:**
Scene:	5	wire mesh, 4 rods, shovel, cord, rods
Type:	Video	
Speaking:	**Scene 5A** (Title: Tools and Materials) To make a wire mesh composter you need about one meter by five meters of wire mesh, three to four one meter metal rods, wire, and a shovel. Transition: Fade **Scene 5B** (Title: Building a Wire Mesh Composter) "Before starting to build the wire mesh composter, you should pick a location. The composter should be at least one meter away from a tree and one meter away from wood structures. Roll the wire mesh out flat. Start at one end of the wire mesh, placing rods approximately every one and a quarter meters. <lay the mesh down and the rods down> Use the cord to tie the rods to the wire mesh. <Demonstrate> Over lap a fourth of a meter of wire mesh, so that the wire mesh forms a circle. <Demonstrate> Secure this circle using more cord. The wire mesh composter is now ready to be placed in its composting location." Transition: Fade **Scene 5C** (Title: Maintaining your composter) "Once materials are added to the bin, they can easily be mixed. You can take a shovel or pitchfork to mix the pile or you can lift up the composter, move it to a nearby location, and transfer the material back into the bin. <demonstrate> This will properly mix the contents of the composter." Transition: Fade **Scene 5D** (Title: Harvesting your compost)" To harvest the compost, simply lift up the wire mesh composter. You can move the now empty composter to a new location, and your harvested compost to your garden."	
Voiceover:		
Visual	Video of actor at a table and in a greenhouse	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	

Notes:	**Color:**	**Font**	**Background**

Name:	Six Hole Method	**Materials:**
Scene:	O	
Type:	Title Page	
Speaking:		
Voiceover:	In this section we will discuss how to compost using the six-hole method. The Six hole method consists of digging a series of holes in the ground and placing the composting materials in them. You begin by filling up the first hole with composting materials. When that hole is mostly full, you cover the rest of it with dirt from a second hole. The second hole is then filled with materials and covered with dirt from a third hole, and so on. By the time you finish six holes, the first hole should be composted, and you can start all over again.	
Visual		**Checklist** Materials? n/a Location? n/a Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**

Name:	Six Hole Method	**Materials:**
Scene:	6	Shovel
Type:	Video	
Speaking:	**Scene 6A** (Title: Tools and Materials): There are not many tools required for the six-hole method. *<display shovel>* All you need is a shovel to dig the holes. Transition: Fade **Scene 6B** (Title: Building your Composter): The six-hole method is the easiest method to build and maintain. You first need to find a suitable location to dig the holes. If you have a garden in your yard, the holes can be dug right in between the plants. This way, the nutrients from the compost will be absorbed directly into the garden. If you do not want to dig in the garden, the holes can be placed anywhere else with sufficient room to dig six holes. The holes should be at least half a meter apart, half a meter wide, and half a meter deep. Begin by digging the first hole and layering the materials in, making sure to keep them moist. When the first hole is almost full, cover it with dirt from a second hole, and begin to layer materials into the second hole. Continue this process over a period of time, as you create more waste materials. By the time you fill a sixth hole with materials, usually within a month or two, the first hole should be finished composting. Transition: Fade **Scene 6C** (Title: Maintaining your composter) If you make the holes in your garden, almost no maintenance needs to be done once you fill and cover the hole. The nutrients will be absorbed directly into the garden as the materials turn to compost. If you notice that a hole is beginning to smell, it is not getting enough aeration, and you should use a shovel to turn the materials. Transition: Fade **Scene 6D** (Title: Harvesting your compost) Again, harvesting is very simple for the six-hole method. If you want, you do not even need to touch the hole once it has been built and composted. An alternative is to dig up the completed compost and spread it in your garden. You can then use that empty hole to fill with more materials.	
Voiceover:		
Visual	Video of actor at a table and in a greenhouse, outside?	

Checklist	
Materials?	√
Location?	√
Filmed?	√

			Edited?	√
Notes:		**Color:**	**Font**	**Background**

Name:	Worm Composting	**Materials:**
Scene:	P	
Type:	Title Page	
Speaking:		
Voiceover:	In this section we will discuss how to compost using worms. This method can be done indoors and is odorless. You will now learn how to setup worm composting and what materials to add.	
Visual		**Checklist** Materials? n/a Location? n/a Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**

Name:	Worm Composting	**Materials:**
Scene:	7	bin, news paper and cardboard, orange, water, worm signs?, sand or soil
Type:	Video	
Speaking:	**Scene 7A** (Title: Tools and Materials): "You need a plastic, or metal bin to put your food scraps and worms in. The 5 to 10 gallon bin should have a tight lid. <demonstrate> The worms used for composting are 'Red Wigglers' or 'Brandling Worms.' <Show these names written out. Also with lumbricus rubellus and eisenia foetida written out too> These worms can be found online, in fishing stores, or in gardening stores. Shredded newspaper or cardboard is needed for assembling the worms' habitat." Transition: Fade **Scene 7B** (Title: Building your Composter): "Find a place in your house for the bin. Drill a few small holes in the lid to give the worms air. The worms need a bedding in order to survive. Bedding should be moist shredded newspaper and cardboard. This bedding should fill half of the bin. Do not compact the bedding. <Demonstrate> About one pound of worms should be used to start with. One pound of worms can eat one pound of food every 3 days." Transition: Fade **Scene 7C** (Title: Maintaining your composter) "The materials that you wish to composted do not need to be separated by browns and greens. The materials that you add, should be added to the bottom of the bin. You may add the same materials to the worm bins that you would add to an outdoor bin, with the exception of citrus fruit peels or scraps.<hold up an orange> Monthly, a pound of soil or coarse sand should be added to the bin." Transition: Fade **Scene 7D** (Title: Harvesting your compost) "The compost product is worm droppings, also known as castings, which are rich in nutrients. Every 3 months, the castings should be harvested and the bedding removed. If the worm bedding is low, the casting and the bedding removal may be done sooner. The bedding and worms should be removed first. Place these in a separate container. Next removed the castings. The castings fall to the bottom of the bin. <show> Be careful not to hurt the worms when removing this. You may put the castings outside or in a pot. Once the castings have been removed, put the bedding back into the bin. Add more bedding if the bedding fills less than half of the bin. <demonstrate>"	

Voiceover:				
Visual	Video of actor at a table and in a greenhouse		**Checklist**	
			Materials?	
			Location?	√
			Filmed?	√
			Edited?	√
Notes:		**Color:**	**Font**	**Background**
Between each topic we'll have a slide introducing the new topic with a title. There will also be pictures in between the video of whatever we need. Cross fade between pictures and between a title and its related section				

Name:	Question and Answer Menu	**Materials:**
Scene:	CC	
Type:	Menu	
Speaking:		
Voiceover:		
Visual	Menu	

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	n/a
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Question and Answer	**Materials:**		
Scene:	Q			
Type:	Title Page			
Speaking:				
Voiceover:	In this section, we willl review some common problems that you may encounter when composting.			
Visual				

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Is Your Compost Not Maturing?	**Materials:**
Scene:	R	
Type:	Informational Page	
Speaking:		
Voiceover:	Your compost may not be decomposing because it is too dry, the pile is too small, or there is not enough green material.	
Visual	Is your compost not maturing? • Moisture Level • Size of Pile • Green/Brown Ratio	**Checklist** Materials? n/a Location? n/a Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**

Name:	Moisture Level	**Materials:**
Scene:	8	soil, watering can
Type:	Video	
Speaking:	To check for the appropriate level of moisture, squeeze the compost. If it feels like a moist sponge and drips one or two drops at most, then the moisture level in your pile is perfect. If it feels dry, add small amounts of water. It is important to cover your compost if there is more than a day's worth of rain. During the rainy season, the compost pile should remain covered.	
Voiceover:		
Visual	Video of actor standing at a table	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Size of Pile	**Materials:**		
Scene:	9			
Type:	Video			
Speaking:	When using the wire mesh method, the pile should be larger than 1 cubic meter. If the pile is too small, the pile will not mature. If you widen the wire mesh composter, the compost will start to mature.			
Voiceover:				
Visual	Video of actor standing at a table	**Checklist**		
		Materials?	√	
		Location?	√	
		Filmed?	√	
		Edited?	√	
Notes:		**Color:**	**Font**	**Background**

Name:	Green/Brown Ratio	**Materials:**
Scene:	10	
Type:	Video	
Speaking:	If you have too many browns you can add greens. To solve this problem simply add more items that are high in nitrogen, such as grass clippings, livestock manure, fruits, vegetables, egg shells, or coffee grounds.	
Voiceover:		
Visual	Video of actor standing at a table At each item it cuts away to photos of them	**Checklist** Materials? √ Location? √ Filmed? √ Edited? √

Notes:	**Color:**	**Font**	**Background**

Name:	Does your compost have an ammonia odor?	**Materials:**
Scene:	11	
Type:	Video	
Speaking:	The ammonia odor is caused by an over abundance of green material. By mixing in more brown material, such as dried grass, leaves, or newspaper, to balance the nitrogen, the ammonia odor should soon be cleared.	
Voiceover:		
Visual	Video of actor standing at a table	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Does your compost have a rotten odor?	**Materials:**	
Scene:	S		
Type:	Informational Page		
Speaking:			
Voiceover:	Too much moisture, not enough oxygen, or food remains on top of the compost can cause rotten odor.		
Visual	Does your compost have a rotten odor? • Moisture Level • Oxygen Level • Unmixed Food Scraps		

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Moisture Level	**Materials:**
Scene:	12	
Type:	Video	
Speaking:	Mixing in dry materials will absorb the moisture from the saturated compost. In particular wood ash prevents odor and absorbs the moisture. Compost should be covered if it is expected to rain for more than a day.	
Voiceover:		
Visual	Video of actor standing at a table	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Oxygen Level	**Materials:**
Scene:	13	
Type:	Video	
Speaking:	Turning the pile will allow oxygen to penetrate material. Aeration allows the materials to finish the composting process. Without oxygen, food scraps and grass do not decompose.	
Voiceover:		
Visual	Video of actor standing at a table	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

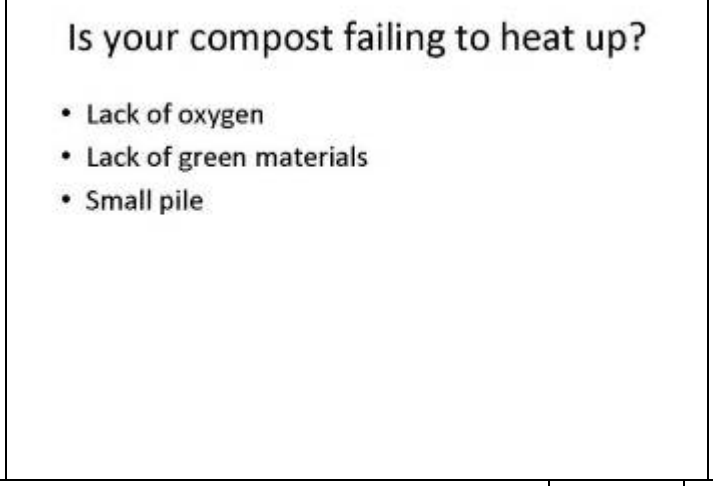
Name:	Unmixed Food Scraps	**Materials:**			
Scene:	14				
Type:	Video				
Speaking:	If an odor is being emitted from food remains, then food should buried at least 25-30 centimeters into the compost.				
Voiceover:					
Visual	Video of actor standing at a table				
			Checklist		
			Materials?	√	
			Location?	√	
			Filmed?	√	
			Edited?	√	
Notes:		**Color:**	**Font**		**Background**

Name:	Is your compost attracting flies?	**Materials:**			
Scene:	15				
Type:	Video				
Speaking:	Avoid putting meat or fatty foods in compost. They attract flies and maggots. By turning the pile frequently, the temperature increase will kill the majority of the larvae.				
Voiceover:					
Visual	Video of actor standing at a table	**Checklist**			
		Materials?	√		
		Location?	√		
		Filmed?	√		
		Edited?	√		
Notes:		**Color:**	**Font**	**Background**	

Name:	Is your compost attracting animals?	**Materials:**
Scene:	16	
Type:	Video	
Speaking:	Meat and fatty foods will also attract large animals. Using a bin with holes smaller than four centimeters will help prevent large animals. The trashcan method is the best method to insure keeping animals away. To keeps rats away you can either make sure that the holes in the trashcan are no larger than one centimeter or cover all sides of a compost pile with hardware mesh cloth with openings less than one centimeter.	
Voiceover:		
Visual	Video of actor standing at a table	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Is your compost failing to heat up?	**Materials:**			
Scene:	T				
Type:	Informational Page				
Speaking:					
Voiceover:	Your compost should reach temperatures above 32 degrees Celsius while it is decomposing. Once it is finished, the temperature should be lower. If the pile is still decomposing and the temperature is too low, it could be caused by lack of oxygen, lack of green materials, or too small of a pile.				
Visual					
Notes:		**Color:**	**Font**	**Background**	

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Name:	Lack of Oxygen	**Materials:**			
Scene:	17				
Type:	Video				
Speaking:	A lack of oxygen can be fixed by turning the composting materials.				
Voiceover:					
Visual	Video of actor standing at a table		**Checklist**		
			Materials?	√	
			Location?	√	
			Filmed?	√	
			Edited?	√	
Notes:		**Color:**	**Font**		**Background**

Name:	Lack of Green Materials	**Materials:**
Scene:	18	
Type:	Video	
Speaking:	If there are not enough green materials, then more nitrogen rich materials such as grass clippings, livestock manure, fruits, vegetables, egg shells, or coffee grounds should be added.	
Voiceover:		
Visual	Video of actor standing at a table	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Small Pile	**Materials:**			
Scene:	19				
Type:	Video				
Speaking:	When using the wire mesh method, the pile should always be larger than one meter by one meter. Or the compost will not heat up and decompose.				
Voiceover:					
Visual	Video of actor standing at a table				

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Is the temperature of your compost above 66 degrees Celsius?	**Materials:**		
Scene:	U			
Type:	Informational Page			
Speaking:				
Voiceover:	Insufficient amounts of oxygen or too much green material can cause high composting temperature. Compost piles should not reach above 66 degrees Celsius. If the pile reaches this temperature, the final compost will not be nutrient rich and the compost will not be good for gardening.			
Visual	Is the temperature of your compost above 66 degrees Celsius? • Lack of oxygen • Too much green material			

Checklist	
Materials?	n/a
Location?	n/a
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

Name:	Lack of Oxygen	**Materials:**			
Scene:	20				
Type:	Video				
Speaking:	A lack of oxygen is easily fixed by turning the pile daily.				
Voiceover:					
Visual	Video of actor standing at a table				
Notes:		**Color:**	**Font**	**Background**	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Name:	Lack of Green Materials	**Materials:**
Scene:	21	
Type:	Video	
Speaking:	An over abundance of green materials can be solved by adding brown materials such as woody material, dried leaves, and paper	
Voiceover:		
Visual	Video of actor standing at a table	

Checklist	
Materials?	√
Location?	√
Filmed?	√
Edited?	√

Notes:	**Color:**	**Font**	**Background**

APPENDIX C: VIDEO PAGE LEVEL HIERARCHY

Level: 1	2	3	4
Main Menu	An Introduction to Composting	What is Composting?	
		Why should you Compost?	
	Composting Methods	Summary of Methods	Summary Introduction
			Garbage Can
			Wire Mesh
			Six-Hole
			Worm Composting
		General Tips	
		Garbage Can Method	Tools and Materials
			Building your Composter
			Maintaining your Composter
			Harvesting your Compost
		Wire Mesh Method	Tools and Materials
			Building your Composter
			Maintaining your Composter
			Harvesting your Compost
		Six-Hole Method	Tools and Materials
			Building your Composter
			Maintaining your Composter
			Harvesting your Compost
		Worm Composting Method	Tools and Materials
			Building your Composter
			Maintaining your Composter
			Harvesting your Compost
	Common Problems	Is you compost not maturing?	
		Does your compost have an ammonia odor?	
		Does your compost have a rotten odor?	
		Is your compost attracting flies?	
		Is your compost attracting animals?	
		Is your compost failing to heat up?	
		Is the temperature of your compost above 66 degrees Celsius?	